2 of 2 in set

7173

USAEC Report No.: SFIM-AEC-IR-CR-95004

U.S. Army Environmental Center

Phase II Remedial Investigations Report, Volume IV - Appendices Sites P11/P13 and A12/P36/P37

Fort Devens Sudbury Training Annex, Maynard, Massachusetts

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APPENDIX A

BORE LOGS

APPENDIX A

BORE LOGS

Appendix A contains field bore logs for the boreholes drilled during Ecology and Environment, Inc.'s performance of environmental investigations at the Sudbury Annex. Please refer to Section 3.1.5.2 of Volume I for a description of borehole drilling and abandonment procedures. Please note that no boreholes were drilled in Site P11/P13.

Boreholes:

E3-A12-B01
E3-A12-B02
E3-A12-B03
E3-A12-B04
E3-P36-B01
E3-P36-B02
E3-P36-B03
E3-P37-B01
E3-P37-B02
E3-P37-B03

BORING LOG GENERAL DATA
Borehole Number: E3-A12-B01
Page: 2 of
Signature: [illegible]
Sent to USATHAMA:
Date Sent:
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Project: SUDBURY ANNEX

Boring: E3-A12-B01

3/11/93

Soil/Rock Description

START/FINISH - 1200/1312

GROUND SURFACE

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery
		0-.5 - DK BROWN SILTY SAND ~~...~~ .5-2' - ORANGE BR - FN GRAINED SND W/ MINOR GRAVEL, SUBROUNDED PHYLLITES, GRANODIORITE QTZITES LOOSE, MOIST.	SS1 $\boxed{1201}$ R=1.4	1 4 4 4
4		4-4.2 TAN FN-MD GR SAND W/GRAVEL FN/MD = 70/30 GRAVEL = [illegible] 4.2-4.4 = MD CS GRAIN SND W/GRAVEL, DK BROWN STAINING 4.4-4.6 BT BROWN FN GR SND, MINOR GRAVEL 4.6-6.0 - MD GRAVELLY SND, GRAVEL QTZITE PHYLLITE, GRANODIORITE SUBROUNDED STAINING. FN/MD/CS = 20/70/10 MOIST, SOME SND/GRAVEL = 80/20%	SS2 $\boxed{1233}$ R=	6 9 14 23
6				
		$H_2O \approx 10'$		
9	▽	VERY MOIST BROWN SILT W/WEATHERED GRAVEL, FE STAINING, TIGHT, TILL GRAVEL WEATHERED PHYLLITE, GRANODIORITE, QTZITES ~~...~~ MORE CLAY AT BOTTOM OF SPOON.	SS3 $\boxed{1244}$ R=1.3	44 40 23 19
11				

Drilling Data

NOTE:
1/ SPLIT SPOONS ARE DRIVEN W/ 140 LB HAMMER W/ 30" FREEFALL
2/ DEPTH & R IN FEET
3/ 4 1/4 HSAs
4/ 2" X 2' SPLIT SPOONS

DRILLING NOTES
1/ DRIVE SPL SP 0-2'
2/ AUGER TO 4'
3/ DRIVE SPL SP 4-6'
4/ AUGER TO 9'
5/ DRIVE SPL SP 9-11'
6/ H_2O @ 10'
7/ REMOVE HSAs
8/ GROUT BH 9-SURFACE

TD = 9'

SAMPLES
4-6' = BX120101 (SAMPLE & DUPLICATE)
9-11 = BX120102

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Project: SUDBURY ANNEX

Boring: E3 A12-B02

8/11/93

START/FINISH-0812/09[illegible]

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		GROUND SURFACE			
		LT BR SILTY SND DRY, LOOSE	SS1 0813 R=.5	6 15 12 7	NOTE: 1/SPLIT SPOONS ARE DRIVEN W/140 LB HAMMER W/30" FREEFALL
2		OVA 0.0 ppm			2/DEPTH & R IN FEET
4		TAN, MOIST FN GRAINED SAND HOMOGENEOUS BECOMING COARSER @ 5.8' - FN/MD = 60/40 W/SUBROUNDED GRAVELS OF PHYLLITE GRANODIORITE, QTZITES	SS2 0834 R=1.5	4 4 9 7	3/4 1/4" HSAs 4/2" X 2' SPLIT SPOONS
6		OVA = 0.0 ppm			DRILLING NOTES: 1/DRIVE SPLIT SP 0-2' 2/AUGER TO 4'
9		H_2O = 11', TIGHT, BR MOIST, CLAYEY SILT W/WEATHERED GRAVEL OF GRANODIORITE, QZITE, PHYLLITE. ~~FIGHTING~~ TILL	SS3 0843 R=1.9	24 33 77 68	3/DRIVE SPL SP 4-6' 4/AUGER TO 9' 5/DRIVE SPL SP 9-11' 6/ H_2O @ ≈ 11'
11	▽	OVA = 0.0 ppm			7/REMOVE HSAs 8/GROUT BH 9' to SURF 9/TD 9'
14		TD 9'			
16					

SAMPLES

4-6' BX120201

9-11 BX120202

BL NG LOG GENERAL DATA

Borehole Number: E3-A12-B02

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Signature:

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Date Sent:

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Project: SUDBURY ANNEX

Boring: E3-A12-B03

Page: 1 of 1

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description (8/10/93; START/FINISH-1604/1707; GROUND SURFACE)	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		MOIST, LT BROWN SANDY SILT W/ GRAVEL, SUBROUNDED QTZITE, PHYLLITE GRANODIORITE, SOME FE STAINS. OVA=0.0 ppm	1604 R=1.7	6 5 9 12	NOTE: 1/ SPLIT SPOONS ARE DRIVEN W/ 140 LB HAMMER W/ 30" FREEFALL 2/ DEPTH & R IN FEET 3/ 4 1/4 HSAs 4/ 2" X 2' SPLIT SPOONS
2					
4		100% SANDY SILT AS ABOVE OVA 0.0 PPM	1620 R=.9	7 4 9 19	DRILLING NOTES: 1/ DRIVE SPLIT SP 0-2 2/ AUGER TO 4' 3/ DR SPL SP 4-6' 4/ AUGER TO 9' 5/ DRIVE SPLIT SP 9-11' 6/ AUGER TO 14 7/ H2O @ 13' 8/ DRIVE SPLIT SP 14-16' 9/ REMOVE AUGERS 10/ POUR GROUT 14 → SURFACE
6					
9		BROWN, MOIST SANDY SILT W/ WEATHERED GRAVEL, QTZITES PHYLLITE GRANODIORITE. TIGHT, SAND IS FN GR TILL OVA = 0.0 PPM	1634 R=1.5	20 25 29 33	
11	▽	H_2O @ 13'	1653		
14		BROWN, WET CLAYEY SILT W/ WEATHERED GRAVEL OF PHYLLITE, QTZITE, GRANODIORITE = TILL OVA = 0.0 ppm	R=1.6	9 12 25 26	
16					

SAMPLES
9-11' - BX120301
14-16 BX120302

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BOF 3 LOG GENERAL DATA
Borehole Number: E3-A12-B03
Page: 2 of
Signature: [signature]
Sent to USATHAMA:
Date Sent:
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Project: SUDBURY ANNEX

Boring: E3-A12-B04

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		8/11/93 START/FINISH-1350/1430 GROUND SURFACE			
		LT BR, DRY, LOOSE, SILT W/SAND & MINOR GRAVEL. GRAVEL SUBANGULAR → SUBROUNDED QTZITE PHYLLITES & GRANODIORITE	SS1 1351 R=.3'	1 2 2 3	NOTE: 1/ SPLIT SPOONS ARE DRIVEN W/140 LB HAMMER W/30" FREEFALL 2/ DEPTH & R IN FEET 3/ 4 1/4" HSAs 4/ 2"X2' SPLIT SPOONS
2					
4		4-5.5 - TAN, FN GRAINED SAND DRY, LOOSE. 5.5-6.0 - LT BROWN SILTY SAND W/MINOR SUBROUNDED GRAVEL. SLIGHTLY MOIST, ~~MORE~~ MORE COHESIVE THAN SAND ABOVE	SS2 1405 R=1.4	1 2 4 10	DRILLING NOTES 1/ DRIVE SPLIT SP 0-2' 2/ AUGER TO 4' 3/ DRIVE SPL. SP 4-6'
6		H_2O ≈ 10'			4/ AUGER TO 9'
9	▽	LT BROWN, MOIST → WET CLAYEY SILT W/WEATHERED GRAVEL OF QTZITE GRANODIORITE, PHYLLITES, SILT IS TIGHT, ~~PLASH~~ SEMI PLASTIC	1416 R=1.3'	11 17 37 24	5/ DRIVE SPL SP 9-11' 6/ H_2O @ ≈ 10' 9/ REMOVE HSAs 10/ GROUT HOLE 9-SURF 11/ TD = 9'
11		TD = 9'			

SAMPLES
4-6 - BX120401
9-11 - BX120402

BORING LOG GENERAL DATA
Borehole Number: E3-A12-B04
Page: 2 of
Signature: Walter Graf
Sent to USATHAMA:
Date Sent:

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BORING LOG GENERAL DATA
Borehole Number: E3-P36-B01
Page: 2 of
Signature:
Sent to USATHAMA:
Date Sent:

33

Project: Sudbury Annex | Boring: E3-P36-B01 | Page: 1 of 1

8/5/93

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		GROUND SURFACE 3" Asphalt			Start Time: 0943 Stop Time: 1115
0		0-0.6' - Silty Sand; med brn; low moisture 40% F, 60% M; 20-30% silt; 20-25% subangular gravels up to 3/4" diam some organics 0.6-1.2' - Silty Sand; lt. brn, 40% F, 60% M; some gravels; low organics; large cobble at bottom of SS	SS1 OVA=0ppm	15, 15, 30, 66 1.2'R	OVA=2ppm downhole 1) Split Spoons Driven w/140lb hammer w/30" Freefall 2) Depth + R in ft 3) 4 1/4 HSAs 4) 2" x 2' split spoons
2		Sand as above - except gravels increasing in size to 1 1/2" diam			
4		Clayey Sand; med brn; moist; 40% F, 60% M; 10-20% clay; some small gravels; large cobble at 4.5'	SS2 OVA=0ppm	6, 25, 26, 24 1.0'R	DRILLING NOTES
6		6.0-6.5' Sand as above 6.5-7.0' Sand as above except 10-20% weathered bedrock; large mica flakes	SS3 OVA=0ppm	4, 6, 29, 32 1.0'R	1) DRIVE SPL SP 0-2' 2) AUGER TO 4' 3) DRIVE SPL SP 4-6
8		Sand as above - large cobbles of mica schist			4) DRIVE SPL SP 6-8 HOMOGENIZE THE SAMPLES 4) AUGER TO 9' 5) DRIVE SPL SP 9-11' 6) AUGER TO 14' TD
9		Silty Sand - gray brown; high moisture at 9.6'; 40% F, 60% M; coarser w/ depth; 10-20% subangular gravels; iron staining throughout; large granite cobble at bottom of spoon	SS4 OVA=0ppm	13, 25, 36, 35 1.2'R	7) DRIVE SPL SP 14-16 H_2O @ 14'
11		Rough Augering Encountered 11-12' Large Cobbles up to 4" diam			
14	Δ	14-14.5' Silty Sand, wet, 20% F 40% M 40% C, some clay and iron staining 14.5-15.0' Gravelly Sand; wet; 40% M, 60% C; gravels up to 1/4" diam throughout	SS5 OVA=0ppm	19, 35 74, - 1.0'R	SS refusal at 15.3'
16		TD = 16'			SAMPLES 4-6 BX360101 14-16 BX360102

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Project: SUDBURY ANNEX

Boring: E3 P36-B02

Page: 1 of 1

8/5/93

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description START/FINISH - 1255/1405 GROUND SURFACE	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		SS1 LT BROWN SILT GRADING TO A DRY YELLOW BR SILTY FN GR SAND	1259 R=.8'	4 5 6 10	NOTE: 1/ SPLIT SPOONS ARE DRIVEN W/ 140 LB HAMMER W/ 30" FREEFALL 2/ DEPTH & R IN FEET 3/ HSAs 4/ 2" X 2' SPLIT SPOONS
		OVA - 0.0 ppm			
2					
4		SS2 DRY TAN ~~FA~~ SILT W/ FINE GR SND, GRAVEL & ROCK, HEAVILY WEATHERED, & FRIABLE, OTHER GRAVEL SUBROUNDED. GRAVEL = GRANODIORITE, QTZITE TILL	1304 R 1.8	26 38 36 41	DRILLING NOTES 1/ DRIVE SPLITSPOON 0-2'
6					2/ AUGER TO 4'
9	▽	SS3 MOIST TAN SILT W/ WEATHERED GRAVEL AS ABOVE. BECOMING WET @ 10'.	1317 R 1.8	18 15 14 10	3/ DR SPL SPOON 4-6' 4/ AUGER TO 9' 5/ DRIVE SPL SP 9-11' 6/ H_2O @ ≈ 10'
		OVA = 0.0 ppm			7/ DRIVE SPLITSPOON 11-13'
11		H_2O @ ≈ 10'			
11		SS4 WET TILL AS ABOVE IRON BANDS @ ≈ 12.5±/12.7'	1339 R-1.6	15 16 27 31	8/ PULL AUGERS 9/ GROUT 9'- SURFACE
		OVA = 0.0 ppm			
13					SAMPLES 4-6' BX360201 9-11 BX360201 VOC 11-13 COMPOSITED W/ ABOVE FOR OTHER SAMPLES

BORING LOG GENERAL DATA
Borehole Number: E3-P36-B02
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Signature: H. Walker [signature]
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Project: SUDBURY ANNEX

Boring: E3-P36-303

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8/13/93

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		GROUND SURFACE ORGANICS			START / FINISH - 1430 / 1600
0		0.0 - 2.0 Dark Brown to orange-tan fine to med. silty sand (~60% F) Some organics. ~10% clay		1, 2, 2, 2, R=0.8	
2		2.0 - 4.0 Orange-tan fine to med. silty sand (~60% F) with ~15% clay			
4		4.0 - 6.0 Tan to gray fine to med. silty sand with ~20% clay and fine to cs pebbles.		18, 28, 30, 32, R= 1.5	
6		6.0 - 9.0 SAA			
		TD BH			
9		9.0 - 11.0 Tan to gray fine to cs silty sand (~40% F) with ½" iron stained bands. slightly cohesive. wet.		18, 25, 24, 20, R= 1.3	
10	▽				
11					

Drilling Data:

1) SPLIT SPOONS ARE DRIVEN WITH 140 POUND HAMMER AT 30 INCH FREE-FALL.

2) DEPTH AND RECOVERY IN FEET.

3) INCH DIA. HOLLOW STEM AUGERS

4) 2 INCH X 2 FEET SPLIT SPOONS

DRILLING NOTES

1) DRIVE SPL SP 0-2
2) AUGER TO 4'
3) DRIVE SPL SP 4-6
4) AUGER TO 9' (TD)
5) DRIVE SPL SP 9-11'
H_2O @ = 10.0'

SAMPLES

4-6 BX360301
9-11 BX360302

BORING LOG GENERAL DATA
Borehole Number: E3-P36-30

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BORING LOG GENERAL DATA

Borehole Number: E3-P37-B01

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Signature:

Xerox: Walter Gray

Sent to USATHAMA:

Date Sent:

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Project: SUDBURY ANNEX

Boring: E3-P37-B01

Page: 1 of 1

8/9/93

START/FINISH - 1145/1233

GROUND SURFACE

Depth/Elevation (Ft.)	USCS Symbol/Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery
0–2		0.→.2' BR SNDY SOIL W/ROOTS .2—2' SLIGHTLY MOIST BROWN MED/CS GRAIN SAND W/GRAVEL, SUBROUNDED QTZITE, PHYLLITES, GRANODIORITES FN/MD/CS (SAND) = 10/50/40 OVA=0.0ppm	SS1 1145 R=1.8	4 7 6 5
4–6		4-5.0. MOIST, TAN, LOOSE MD/CS GR SAND W/GRAVEL SUBROUNDED QTZ PHYLLITE, GRANODIORITES, SND/GRAVEL 90/10 INCREASING GRAVEL DOWN-SECTION. FN/MD/CS 20/40/40 COARSENING DOWN SECTION. 5-6.0 - MOIST, TAN FN/MD/CS GR SAND W/ GRAVEL (AS ABOVE) FINES INCREASING F/M/C = 30/40/30 OVA = 0.0ppm	1151 SS2 R=1.3	5 6 6 10
9–11		TAN, MOIST MD/CS GR SAND W/GRAVEL. FN/M/CS = 10/40/50 GRAVEL SUBROUNDED, PHYLLITE QTZITE, GRANODIORITES, SOME WEATHERING, 10-11' - FN/MD GRAINED GRAVEL. MOIST FN/MD = 40/60 NO GRAVEL MINOR CS GRAINS	1201 R=1.3'	4 5 5 6
14–16		H_2O @ 14' 14-15 WET FN GR SAND W/MINOR SILT (<10%). FE BANDING, 15-15.5 MD/CS GR GRAVELLY SND GRAVEL WEATHERED, QTZITE PHYLLITE, GRANODIORITE ~~15.5~~ 15.5-16 FN GR SILTY SAND W/ SILTY CLAY BANDING, TIGHT PLASTIC	1210 R=1.3	8 11 14 19

Drilling Data

NOTE

1/ SPLIT SPOONS DRIVEN W/140LB HAMMER W/ 30" FREE FALL.

2/ DEPTH & "R" IN FEET

3/ 4 1/4" HSAs

4/ 2" X 2' SPLIT SPOONS

DRILLING NOTES

1/ DRIVE SPLIT SP 0-2'

2/ AUGER TO 4'

3/ DRIVE SPLIT SP 4-6'

4/ AUGER TO 9'

5/ DRIVE SPLIT SP 9-11' SAMPLE ~~BX370~~ BX370101

6/ AUGER TO 14'

8/ H_2O @ 14'

9/ DRIVE SPL SP 14-16

10/ REMOVE HSAs

11/ GROUT BH 14-SURFACE

SAMPLES

9-11' - BX370101*

14-16' BX370102 (W/DUP)

* THE DUPLICATE SAMPLE FOR THIS INTERVAL WAS CHANGED TO INTERVAL FROM 14-16

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BORING LOG GENERAL DATA
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Project: SUDBURY ANNEX

Boring: E3 P37-B02

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description 8/6/93 START/FINISH - 1420/1515 GROUND SURFACE	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		0-.2' BROWN SANDY SILT DRY LOOSE .2-1 CS GR SND W/GRAVEL LOOSE 1-2' MOIST, TAN, MD/CS SAND W/GRAVEL GRAVEL SUBROUNDED GRANODIORITE QTZ PHYLLITES MD/CS = 50/50	SS1 1420 R=	3 4 3 4	NOTE: 1/ SPLIT SPOONS ARE DRIVEN W/140 LB HAMMER W/30" FREEFALL 2/ DEPTH & R IN FEET 3/ 4 1/4 HSAs 4/ 2" X 2' SPLIT SPOONS
2					
4		MOIST, TAN, MED/CS GRAINED SAND W/GRAVEL, LOOSE MD/CS/FN 70/20/10. GRAVEL <10%, GRANODIORITE, QTZ, QTZITE, PHYLLITE	SS2 1428 R=1.5	4 4 4 6	
6					DRILLING NOTES 1/ DRIVE SPL SP 0-2' 2/ AUGER TO 4' 3/ DRIVE SPL SP 4-6' 4/ AUGER TO 9'
9		9-10' TAN MED/CS/GRAINED SAND MOIST, MINOR GRAVEL <5% 10-11' 100% FN GRAINED SILTY SAND FE BANDS (STREAKS)	SS3 1438 R=1.6	4 4 5 6	5/ DRIVE SPLIT SP 9-11' 6/ AUGER TO 14'
11			SS4 1459		
14	▽	H_2O @ 14.0' HOMOGENEOUS WET TAN 100% FN GRAINED SILTY SAND AS ABOVE, FE BANDING	R=1.7	5 5 6 7	7/ DRIVE SPL SP 14-16' 8/ H_2O @ 14' 9/ REMOVE HSAs 10/ GROUT 14 - 0 SURF
16		TD · 14'			SAMPLES 9-11' - BX370201 14'-16 BX370202 MSD - 14-16'

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Borehole Number:

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Xerox:

Date Sent:

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Project: SUDBURY ANNEX

Boring: E3-P37-B03

8/16/97

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		GROUND SURFACE			Time Start : 0821 Time Stop : 0940
0		0-0.4 Silty Sand; dark brn; low moisture; 60%F, 40%M; high organics 0.4-1.2' Silty Sand; med. brn to lt. brn; low moisture; 20%F, 60%M, 20%C; 0-15% gravels up to ¼" diam; iron staining; minor organics	SS1 OVA	2, 4, 6, 7 1.2'R	1) SPLIT SPOONS ARE DRIVEN WITH 140 POUND HAMMER AT 30 INCH FREE-FALL.
2		Silty Sand; med brn; moist; 40%F, 60%M; no gravels; few organics			2) DEPTH AND RECOVERY IN FEET.
4		4.0-4.5 Silty Sand; med brn; moist; 20%F 40%M, 40%C; 10-15% gravels up to ⅛" diam 4.5-5.2 Silty Sand; lt. brn; moist; 40%F, 60%M some coarser layers; iron staining; few small gravels	SS2 OVA =	2, 7, 7, 6 1.2'R	3) 4¼ INCH DIA. HOLLOW STEM AUGERS 4) 2 INCH X 2 FEET SPLIT SPOONS
6		↓			DRILLING NOTES
9		9.0 Silty Sand; med brn; high moisture; 20%F; 60%M; 20%C w/ increasing fines w/depth; iron staining throughout; few small gravels	SS3 OVA =	7, 10, 10, 12 1.7'R	1) DRIVE SPL SP 0-2 2) AUGER TO 4' 3) DRIVE SPL SP 4-6 4) AUGER TO 9' 5) DRIVE SPL SP 9-11'
11 / 12		↓			6) AUGER TO 14' (TD)
14		14-14.2' Silty Sand; grey brn; wet 20%F; 40%M, 40%C; iron stained minor clay lenses present 14.2-14.4 Clayey Sand; grey brn; wet 80%F; 20%M; dense; low plasticity	SS4 OVA =	6, 7, 7, 9 1.4'R	7) DRIVE SPLIT SP 14-16 H₂O @ ≈ 12' 8) REMOVE HSAs 9) GROUT 14' TO SURF
16		TD = 14'			

SAMPLES

4-6 BX370301

14-16 BX370302

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B

APPENDIX B

WELL CONSTRUCTION LOGS

APPENDIX B

Appendix B contains field well construction schematics and field bore logs for monitoring wells installed by Ecology and Environment, Inc. (E & E) at the Sudbury Annex. Please refer to Section 3.1.2 of Volume I for a description of well installation procedures. The logs are organized by watershed.

WATERSHED 1B

GROUNDWATER MONITORING WELLS

E3-P11-M01
E3-P13-M01
E3-P13-M02
E3-P13-M03
E3-P13-M04

SUDBURY ANNEX

WELL CONSTRUCTION LOG

Page: 1 of ~~3~~ 4

Site ID: P11

Well Number: E3-P11-M01

Job Number: UC60666

Today's Date: 08/03/93

Well Start/Completion Dates: 08/03/93 / 08/03/93

Installation Difficulties: Bottom of screen caught on auger - pulling augers pulled the well; had to tremmy well back down.

Remarks:

Check as appropriate, record depths as below ground surface (BGS)

Screen:

Manufacturer: BEDROCK ENTERPRISES INC.

Schedule: 40

Type: Continuous Slot HORIZONTAL SLOT, 1/4 INCH SPACING

Perforated

Louvre

Other

Materials: Stainless Steel

PVC X

Other

Length: 10 FEET

Screened Interval: 8.0' - 18.0'

Diameter: (ID) 4.0 INCHES (OD) ~~4.25~~ 4.50 INCHES

Thickness: ~~0.0200~~ 0.25"

Slot: Size (inches): 0.020 Configuration: 1/4" HORIZ. SLOT

Open Area per Foot of Screen: ~~0.96 INCHES~~ 151 INCHES²

Casing

Manufacturer: BEDROCK ENTERPRISES INC.

Schedule: 40

Material: Stainless Steel

PVC X

Other

Length: 10'

Diameter: (ID) 4.0" (OD) ~~4.25"~~ 4.50"

Thickness: 0.25"

Joint(s): Design THREADED

Composition

Depth(s)

Centralizer: Design N/A

Composition

Depth(s)

Solvent, Glues, Cleaners: Manufacturer N/A

Use(s)

Protective Casing: Material STEEL

Inner Diameter 6 INCH

WELL CONSTRUCTION LOG
Well Number:
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Xerox:
Sent to USATHAMA:
Date Sent:

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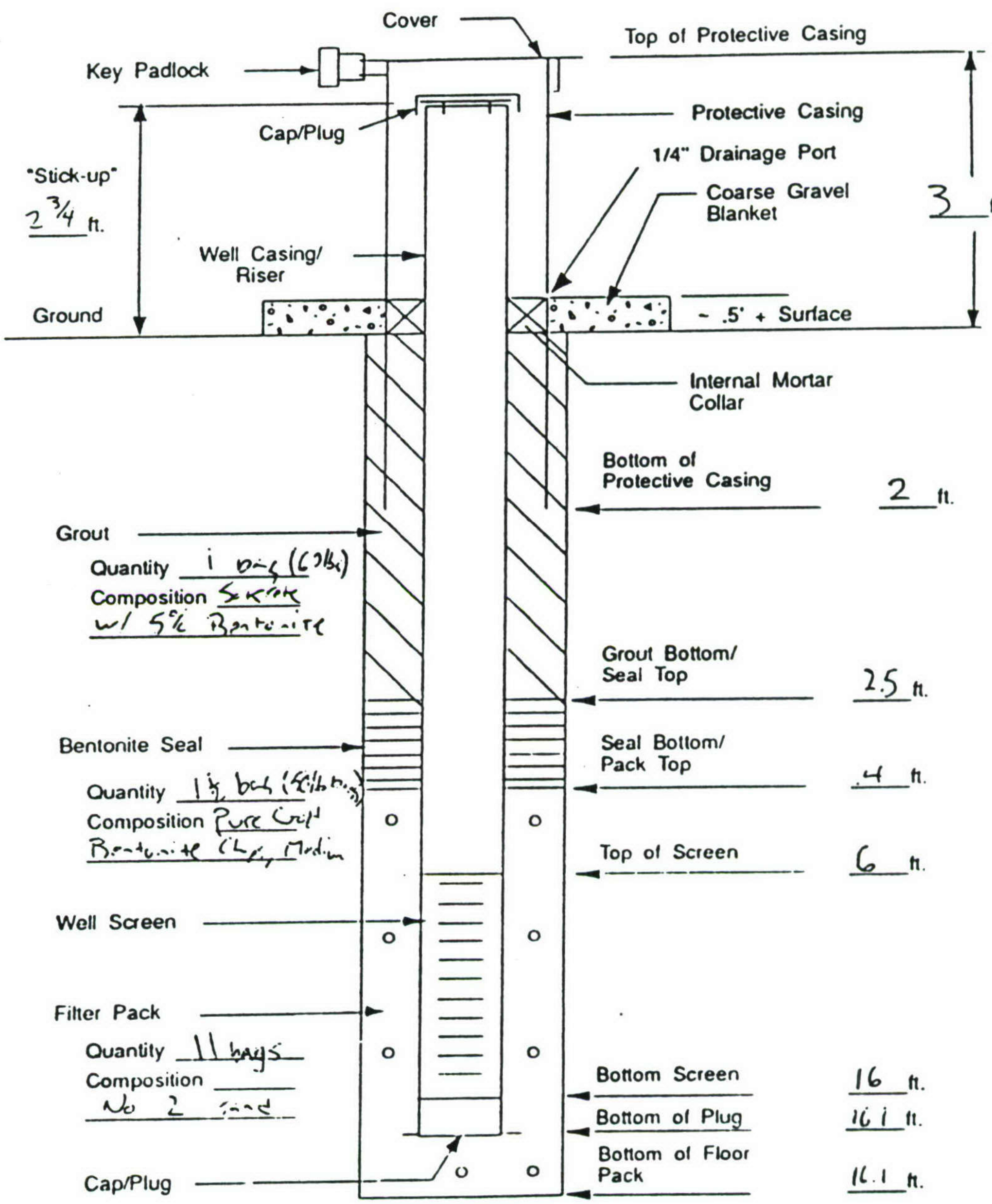
usainfo.cdr

WELL CONSTRUCTION LOG
Well Number: ______
Page 2 of 3
Signature:
Xerox:
Sent to USATHAMA:
Date Sent:

Well Construction Log: ______
Site ID Number: E3-P13- P11
Well Number: E3-P11-MO1
Today's Date: 08/03/93

WELL CONSTRUCTION



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BORING LOG GENERAL DATA
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Sent to USATHAMA:
Date Sent:
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Project: Sudbury Annex

Boring: E3-P11-M01

Page: 3 of 4

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		GROUND SURFACE 1" Organic			Time Start: 0845 Time Complete: 1000
0		0-0.4 - Silty Sand, medium brown, low moisture, 30% F, 60% M, 10% C 20-25% gravels up to 1" diam. some organics 0.4-0.8 - Silty Sand; dark brown, low moisture, 40% F, 60% C; 15-20% gravel up to ½" diam; high organics	SS1 (0-2') OVA=0ppm	3, 5, 11, 10 R=0.8'	① 6¼" HSA ID ② 2" split spoons drive by 140 lb hammer w/ HSA 0-4'
2		Sand as above - decrease in gravels, decrease in organics medium brown.			
4		Sand as above - except 50% F, 50% M, decrease in organics increase in moisture at bottom of spoon.	SS2 (4-6') OVA=0ppm	7, 11, 10, 13 R=0.2'	Split Spoon pushing cobble. HSA 4-9'
6		Silty Sand - medium brown, 20% F 40% M, 40% C, 5-10% gravels 1/4" diam. High moisture wet at ≅ 8 ft			OVA = 2ppm down hole
9		9-9.6' Silty Sand - Grey Brown, High moisture → wet; 90% F, 10% M, 20-30% silt, minor clay; dense; moderate plasticity 9.6-10.2' Sand as above except 70% F, 30% M	SS3 (9-11') OVA=0ppm	4, 10, 10, 11 R=1.2'	HSA 9-14'
11		↓			
14		Sand as above - except 90% F, 10% M	SS4 OVA=0ppm	8, 10, 12, 5 R=0.8'	HSA 14-19'
16		Sand as above w/ increased grain size to bottom		~~8, 10, 12, 5~~ ~~R=0.8'~~	
19		19' Bottom of Boring			

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BORING LOG GENERAL DATA

Project: sudbury Annex   Boring: E3-P11-MØ1   Page: 4 of 4

Driller & Company: Dave Gagne / ESD

Geologist/Logger & Company: John Pasch/E+E   Signature: [signature]

Date Boring Started: 8/3/93   Completed: 8/3/93

Water Levels (from Ground Surface)   Drilling Rig: Mobil

First Encountered: 8.0'   Date: 8/3/93

While Drilling: 8.0'   Date: 8/3/93

At Boring Completion: 8.0'   Date: 8/3/93

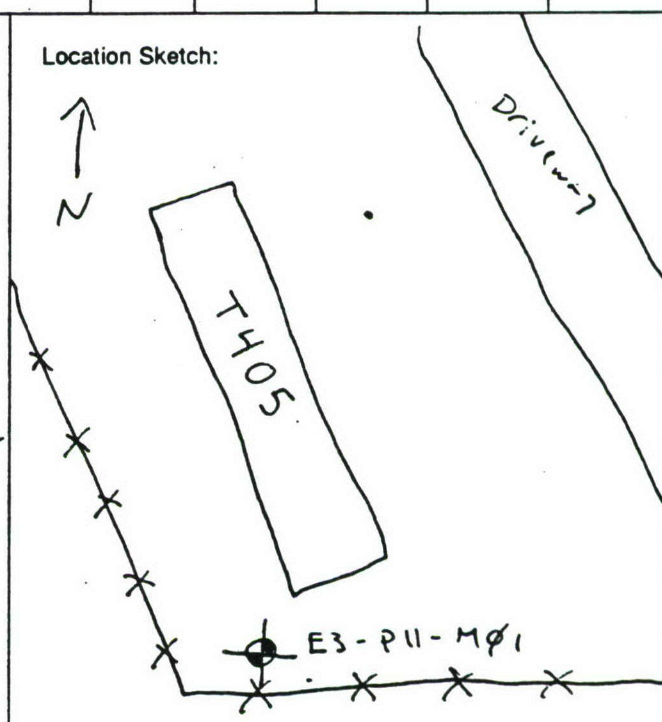
Drilling Shifts:

Date	Time		Depth of Drilling Per Shift		Date	Time		Depth of Drilling Per Shift	
	Start	End	Start	End		Start	End	Start	End
8/3	0845	1000	0'	19'					

Abbreviations:

Abbr.	Meaning
SS	Split spoon
R	Recovery
F	Fine
M	Medium
C	coarse
HSA	hollow stem auger
ID	inner diameter
SAA	same as above

Location Sketch:



BORING LOG GENERAL DATA
Borehole Number: ______ Page: 1 of ______ Signature: ______ Xerox: ______ Sent to USATHAMA: ______ Date Sent: ______

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WELL CONSTRUCTION LOG
Page 1 of 3
Sent to USATHAMA:
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Signature:
Well Number:

Page: 1 of 3 5

WELL CONSTRUCTION LOG

Site ID:
Well Number: E3-P13-01
Job Number: UC6066
Today's Date: 8/3/93
Well Start/Completion Dates: 8/2/93 / 8/3/93

Installation Difficulties:

Remarks:

Check as appropriate, record depths as below ground surface (BGS)

Screen:

Manufacturer: Bedrock Enterprises Inc.
Schedule: 40
Type: Continuous Slot Horizontal Slot 0.25" Spacing
Perforated
Louvre
Other

Materials: Stainless Steel
PVC X
Other

Length: 10 ft
Screened Interval: 9.0' - 19.0'
Diameter: (ID) 4.0" (OD) 4.5"
Thickness: 0.25"
Slot: Size (inches): 0.020 Configuration: HORIZONTAL SLOT
Open Area per Foot of Screen: 6.27 in²/ft

Casing

Manufacturer: Bedrock Enterprises Inc.
Schedule: 40
Material: Stainless Steel
PVC X
Other

Length: 10'
Diameter: (ID) 4.0" (OD) 4.50"

Thickness: 0.25"

Joint(s): Design Threaded
Composition PVC
Depth(s) 9.0'

Centralizer: Design N/A
Composition
Depth(s)

Solvent, Glues, Cleaners: Manufacturer N/A
Use(s)

Protective Casing: Material Steel
Inner Diameter 6"

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WELL CONSTRUCTION LOG
Well Number:

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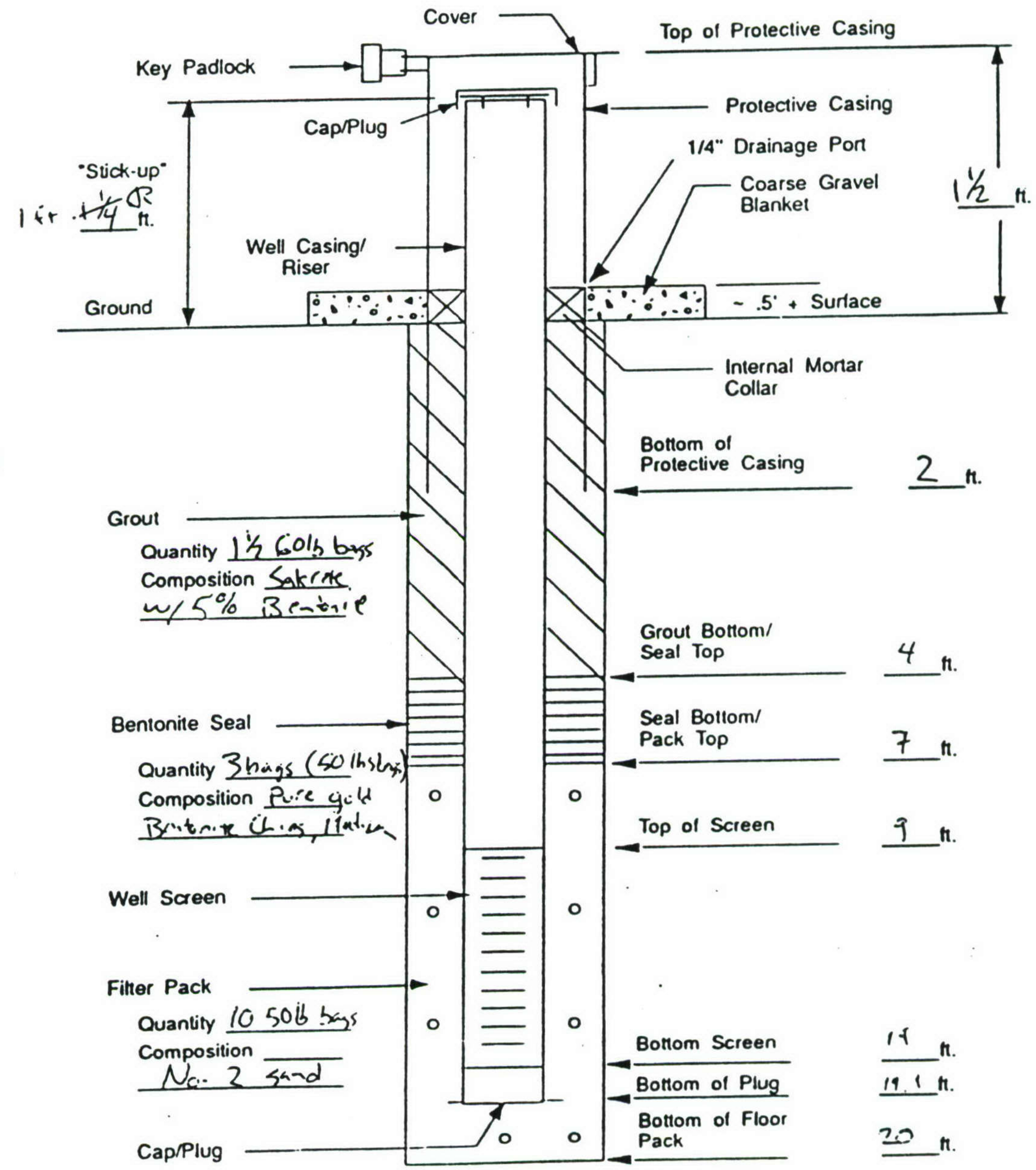
Sent to USATHAMA:
Date Sent:

Well Construction Log:
Site ID Number: P13
Well Number: F3 - P13 - 01
Today's Date: 8/3/93

WELL CONSTRUCTION



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BORING LOG GENERAL DATA
Borehole Number: E3-P13-MO1
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Date Sent:
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Project: SUDBURY ANNEX

Boring: E3-P13-MO1

Page: ~~1~~ 3 of ~~2~~ 5

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data START/FINISH - ~~0845/1000~~ 1627/1737 JR
		GROUND SURFACE ORGANICS			8/2/93
		0.0 - 0.5 DARK BROWN SILTY SAND (75% FINES)	SS-1	4, 8, 8, 7, R=1.5	Ø ppm OVA
		0.5 - 2.0 LIGHT BROWN SILTY SAND (95% FINES)			
2		2.0 - 4.0 LIGHT BROWN TO BROWN SILTY SAND WITH SOME FINE QUARTZ PEBBLES AND VERY COARSE SAND GRAINS			
4		4.0 - 6.0 BROWN MEDIUM TO COARSE SAND WITH 10% FINE QTZ PEBBLES (SOME IRON STAINS)	SS-2	2, 5, 5, 9, R=1.0	Ø ppm OVA
6		6.0 - 9.0 LIGHT BROWN TO BROWN MEDIUM TO COARSE SAND WITH 15% FINE TO MEDIUM QUARTZ PEBBLES			
9		9.0 - 11.0 LIGHT BROWN TO TAN MEDIUM TO COARSE SAND WITH IRON STAINING ON SOME GRAINS. SLIGHTLY MOIST.	SS-3	5, 5, 5, 6, R=0.7	Ø ppm OVA
11		11.0 - 14.0 SAA			
14	▽	14.0 - 16.0 SATURATED LIGHT BROWN MEDIUM TO COARSE SAND WITH IRON STAINED GRAINS AND TENDRILS OF STAINING	SS-4	0.5, 0.5, 1, 2.5, R=2	Ø ppm OVA
16		16.0 - 19.0 SAA			
19					

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BORING LOG GENERAL DATA
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Project: SUDBURY ANNEX | Boring: E3 - P13 - MC1 | Page: 4 of 5

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		GROUND SURFACE			
19		19.0 - 21.0 SAA WITH MINOR CLAY LENSES.		2 5 6 5 R = 1	0.25 ppm OVA
21		21.0 - 23.0 SAA, NO CLAY, 10% FINE MICA FLAKES			RUNNING SANDS AT ≈ 20' TD (DRILLED) 23' TD (OPEN HOLE) 20'
23		TD BOREHOLE			SAMPLE 19-21' - BX1301X1

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BORING LOG GENERAL DATA
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BORING LOG GENERAL DATA

Project: Sudbury Annex Boring: E3-P11-MØ1 Page: 5 of 5

Driller & Company: Dave Gagne / ESD

Geologist/Logger & Company: John Pasch / E+E Signature: [signature]

Date Boring Started: 8/2/93 Completed: 8/2/93

Water Levels (from Ground Surface) Drilling Rig: Mobil

First Encountered: 14' Date: 8/2/93

While Drilling: 14' Date: 8/2/93

At Boring Completion: 14' Date: 8/2/93

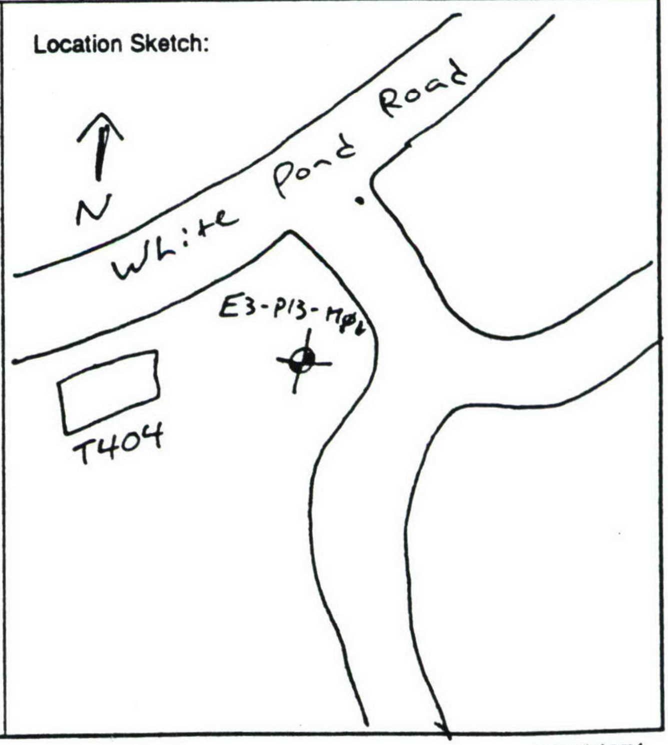
Drilling Shifts:

Date	Time		Depth of Drilling Per Shift		Date	Time		Depth of Drilling Per Shift	
	Start	End	Start	End		Start	End	Start	End
8/2	1627	1737	0'	23'					

Abbreviations:

Abbr.	Meaning
SS	Split Spoon
R	Recovery
F	Fine
M	Medium
C	coarse
HSA	hollow stem auger
ID	inner diameter
SAA	same as above

Location Sketch:



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SUDBURY ANNEX 4

WELL CONSTRUCTION LOG

Site ID:
Well Number: E3-PB-M02
Job Number:
Today's Date: 8/3/93
Well Start/Completion Dates: 8/3/93, 8/3/93

Installation Difficulties: RUNNING SILT AT BOTTOM

Remarks:

Check as appropriate, record depths as below ground surface (BGS)

Screen:

Manufacturer: BEDROCK ENTERPRISES INC
Schedule: 40
Type: Continuous Slot HORIZONTAL
Perforated
Louvre
Other

Materials: Stainless Steel
PVC X
Other

Length: 10'
Screened Interval: 8-18'
Diameter: (ID) 4.0" (OD) 4.5"
Thickness: .25"
Slot: Size (inches): .020" Configuration: HORIZONTAL SLOT
Open Area per Foot of Screen: 6.27 in^2/ft

Casing

Manufacturer: BEDROCK ENTERPRISES INC
Schedule: 40
Material: Stainless Steel
PVC X
Other

Length:
Diameter: (ID) 4.0" (OD) 4.5"
Thickness: .25"
Joint(s): Design THREADED
Composition PVC
Depth(s) 8.0'

Centralizer: Design
Composition N/A
Depth(s)

Solvent, Glues, Cleaners: Manufacturer NONE
Use(s)

Protective Casing: Material HARDENED STEEL
Inner Diameter 6"

WELL CONSTRUCTION LOG
Well Number:
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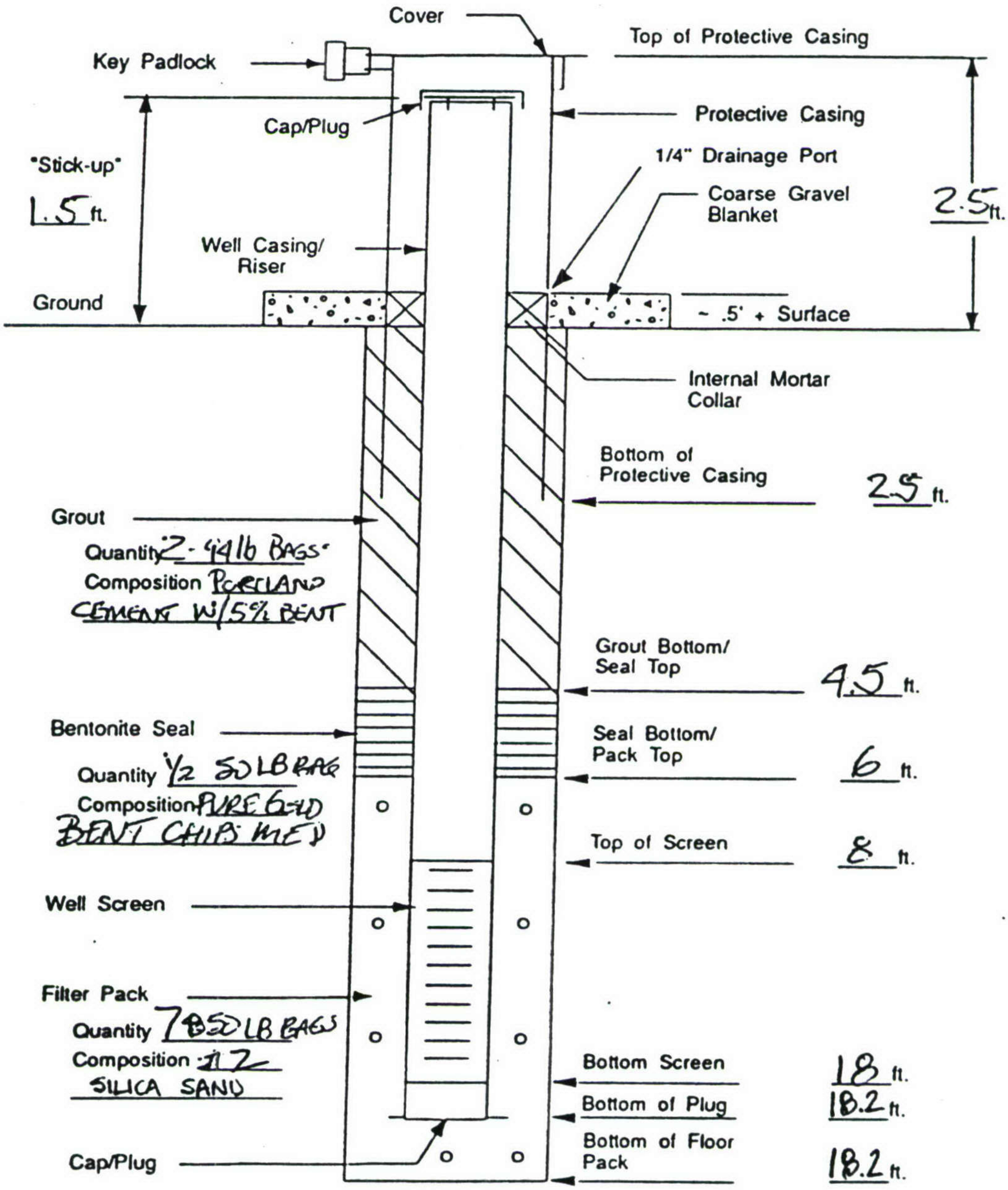
Well Construction Log:

Site ID Number:

Well Number: E3-P13-M02

Today's Date: 8/3/93

WELL CONSTRUCTION



WELL CONSTRUCTION LOG
Well Number: E3-P13-M02
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Signature:
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Project: SUDBURY ANNEX | Boring: E3-P13-M02 | Page: 3 of 4

8/3/94

START/FINISH-1045/13:20

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description (GROUND SURFACE)	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		SS1 DARK, SILT W/ROOTS .2' REST OF SPOON DRY BROWN GRAVELLY SAND GRAVEL 1/8" .25-1" qtzite, granodiorite, phyllite-sand CS/MED/FN = 20/60/20	1050 R=.5	2 4 6 5	NOTE: 1/ SPLIT SPOONS DRIVEN W/140LB HAMMER W/30" FREE FALL 2/ DEPTH & "R" IN FT 3/ 8 1/4" HSA 4/ 2"x2' SPLIT SPOON
2					
4	▽	H2O depth = 4.0'			
		SS2 GREY BR. WET GRAVELLY SAND GRAVEL UP TO 1" diam GRANODIORITE, QTZITE, PHYLLITE GRAVEL SUBANGULAR FN/MED/CS SND = 30/40/20	1100 R=.9	10 8 9 6	DRILLING NOTES 1/ DRIVE SPL. SP 0-2' 2/ AUGER TO 4' 3/ DR SPL SP 4-6'
6					
9		SS3 WET GREY MED FN GR SND W/GRAVEL ~~& FINES~~ FN. GRAVEL SUBANGULAR QTZ, QTZITE, GRANODIORITE SAND MED/FN/CS 50/45/5 MINOR MICACEOUS GRAINS	1107 R=1.0	2 2 2 3	4/ H2O depth = 4' 5/ Auger to 9' 6/ Dr. Spl. spoon 9-11 7/ AUGER TO 14 8/ SPL SP 14-16' * 9/ AUGER TO 18' 10/ INSTALL WELL
11					
14		SS4 - MED FN GRAINED GREY SAND M/F/C - 60/30/10, minor subrounded GRAVEL QTZITE GRANODIORITE, PHYLLITE	1120 R=.6	1 1 1	-14.6 -15.6
16					* LAST SPOON TOOK 1 BLOW FOR ~~2ND FOOT OF~~ 1.5 to 2.5 FEET OF SPOON
18		TD = 18'			SAMPLE 9'-11' BX1302X1

BORING LOG GENERAL DATA

Borehole Number: E3-P13-M02 Page: 2 of

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BORING LOG GENERAL DATA

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Project: SUDBURY ANNEX   Boring: E3 P13-MC 2   Page: 1 of 1

Driller & Company: MARK THIBODEAU / ES

Geologist/Logger & Company: W GRAF / E&E   Signature: Walter Graf

Date Boring Started: 8/3/93   Completed: 8/3/93

Water Levels (from Ground Surface)   Drilling Rig: INGERSOLL RAND A300

First Encountered: 4.0'   Date: 8/3/93

While Drilling: 4.0'   Date: 8/3/93

At Boring Completion: 4.0   Date: 8/3/93

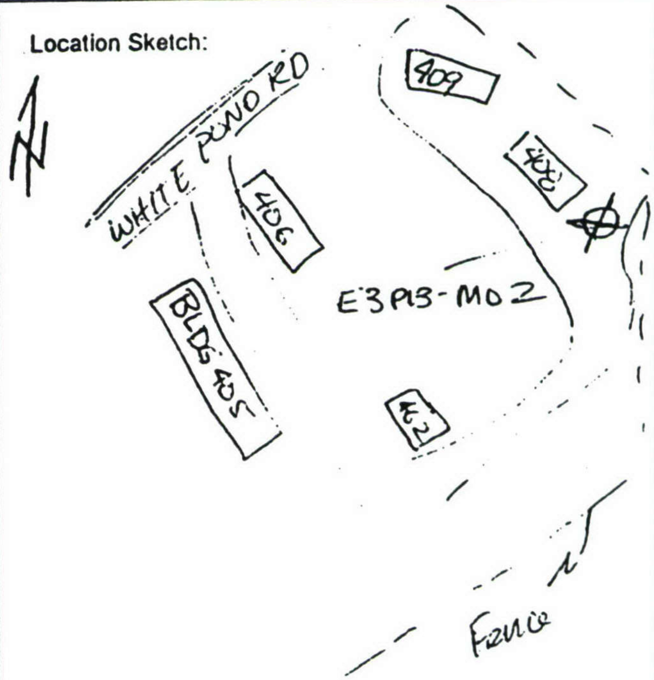
Drilling Shifts:

Date	Time		Depth of Drilling Per Shift		Date	Time		Depth of Drilling Per Shift	
	Start	End	Start	End		Start	End	Start	End
8/3	1045	1320	0	18					

Abbreviations:

Abbr.	Meaning
SPL SP	SPLIT SPOON
R	RECOVERY

Location Sketch:



BC 3 LOG GENERAL DATA
Borehole Number: ______
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WELL CONSTRUCTION LOG

Site ID: SUDBURY
Well Number: E3-P13-M03
Job Number:
Today's Date: 8/3/93
Well Start/Completion Dates: 8/3/93 , 8/3/93

Installation Difficulties:

Remarks:

Check as appropriate, record depths as below ground surface (BGS)

Screen:

Manufacturer: BEDROCK ENTERPRISES
Schedule: 40
Type: Continuous Slot HORIZONTAL SLOT
Perforated
Louvre
Other

Materials: Stainless Steel
PVC X
Other

Length: 10'
Screened Interval: 8-18'
Diameter: (ID) 4" (OD) 4 1/2"
Thickness: 1/4"
Slot: Size (inches): .02 Configuration: HORIZONTAL SLOT
Open Area per Foot of Screen: 6.27 in²/ft

Casing

Manufacturer: BEDROCK ENTERPRISES
Schedule: 40
Material: Stainless Steel
PVC X
Other
Length: 10'
Diameter: (ID) 4" (OD) 4 1/2"
Thickness: 1/4"
Joint(s): Design THREADED
Composition
Depth(s) 8.0'
Centralizer: Design N/A
Composition
Depth(s)
Solvent, Glues, Cleaners: Manufacturer NONE
Use(s)
Protective Casing: Material HARDENED STEEL
Inner Diameter 6.0"

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WELL CONSTRUCTION LOG
Well Number:
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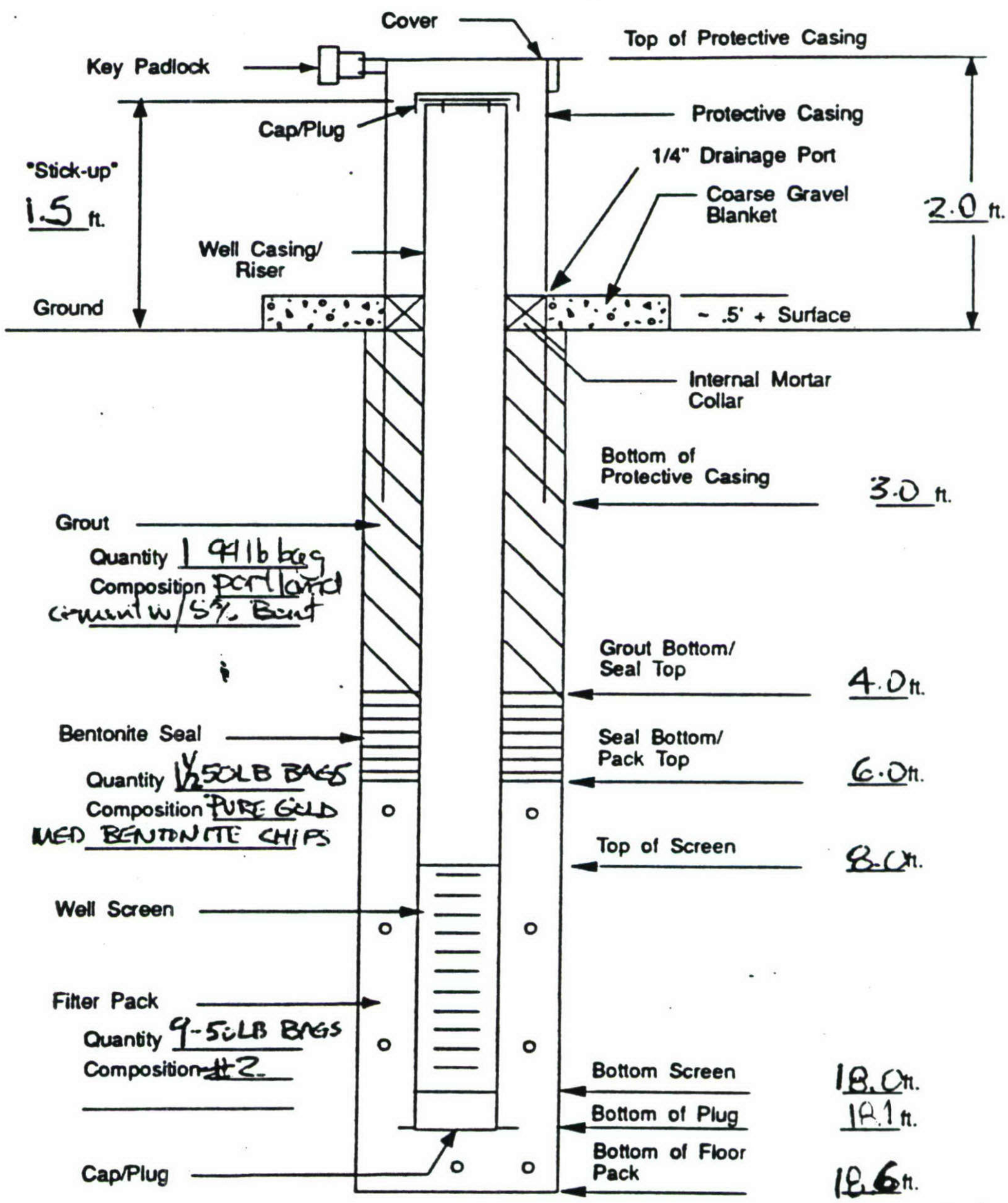
Well Construction Log:

Site ID Number: P13

Well Number: E3 P13 MD3

Today's Date: 8/3/93

WELL CONSTRUCTION



WELL CONSTRUCTION LOG
Well Number:

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BORING LOG GENERAL DATA
Borehole Number: E3-P13-MD3

Page: 2 of
Signature: [illegible]

Xerox:

Sent to USATHAMA: Date Sent:

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Project: SUDBURY ANNEX | Boring: E3-P13-M03 | Page: ~~2~~ 3 of 4

8/3/93

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description START/FINISH – 0805/1330 GROUND SURFACE	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		SS1 TOP .2' - DK.BR SILTY SND GRADING TO FN GR SAND - TAN (.2-.7') .7-4.1 BROWN FN GR SN GRADING TO MED SND TAN WITH GRAVEL OF QTZITE, PHYLLITE WHOLE SPOON DRY + SLIGHTLY MOIST OVA 0.0ppm	0805 R=1.1	4 5 6 5	NOTE: 1/ SPLIT SPOON DRIVEN W/ 140 LB HAMMER W/ 30" FREEFALL 2/ DEPTH & "R" IN FEET 3/ 8 1/4 HSA 4/ 2" X 2' SPLIT SPOON
2					
4		~~MOIST~~ SS2 MED SND TAN W/GRAVEL OF QTZITE, PHYLLITE 80% ~~w/~~ GRADING TO MED FN GR W/MINOR GRAVEL MED/FN = 50/50. BOTTOM OF SPOON FN GR SND TAN WET OVA 0.0 ppm WET @ ≈ 5.5'	0820 R=1.5	3 3 3 4	DRILLING NOTES 1/ DR SPL.SP 0-2' 2/ AUGER TO 4' 3/ DR SPL.SP 4-6' 4/ H_2O ≈ 5.5'
	▽ 5.5'				
6					
9		SS3 WET, GREY, SILTY SND. ORANGE BAND OF SILTY SAND .2' WIDE ~~[illegible]~~ at ≈ 9.5'. REMAINDER OF SPOON GREY SILTY SND SAMPLES COLLECTED - TOC & GR SIZE OVA - 0.0ppm	R=1.4 0824	3 4 3 4	5/ AUGER TO 9' 6/ DR SPL.SP 9-11' 7/ AUGER TO 14' 8/ DR SPL.SP 14-16' 9/ AUGER TO 18'
11					
14		SS4 100% WET, GREY, SILTY SAND, PLASTIC, HOMOGENEOUS OVA - 0.0 ppm	[ ] R=1.8	WEIGHT HAMMER 3	OF ROD 14-15 WEIGHT OF ROD 15-15.6 WEIGHT OF HA. 15.6-16.3 10/ INSTALL CASING 11/ COMPLETE WELL
16					
18		18' = TD			SAMPLES BX1303X1 - GR SIZE, TOC 9-11'

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BORING LOG GENERAL DATA

4 4

Project: SUDBURY ANNEX Boring: ~~E3-P13-M02~~ 305 Page: ~~1~~ of X

E3-P13-M03

Driller & Company: MARK THIBODEAU/ESI

Geologist/Logger & Company: WALTER GRAF / E & E Signature: Walter Graf

Date Boring Started: 8/3/93 Completed: 8/3/93

Water Levels (from Ground Surface) Drilling Rig:

First Encountered: 5.5' Date: 8/3/93

While Drilling: Date: 8/3/93

At Boring Completion: 5.5 Date: 8/3/93

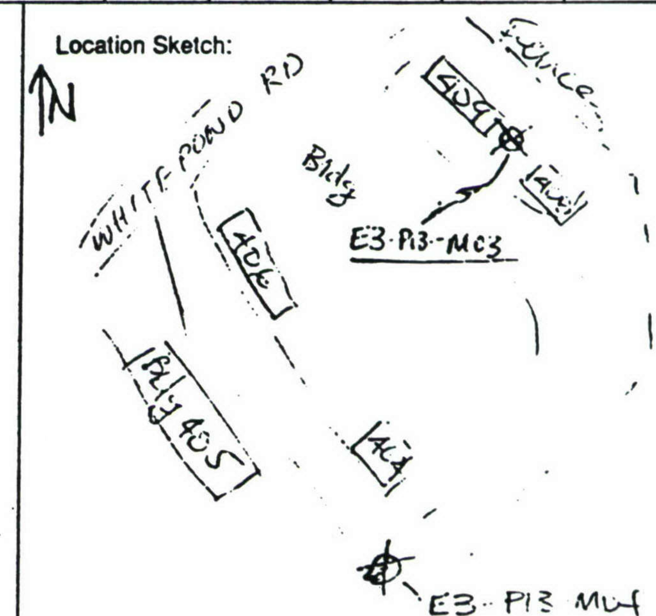
Drilling Shifts: 1

Date	Time		Depth of Drilling Per Shift		Date	Time		Depth of Drilling Per Shift	
	Start	End	Start	End		Start	End	Start	End
8/3	0805	1330	0'	18.6'					

Abbreviations:

Abbr.	Meaning
SPL SP	SPLIT SPOON
R =	RECOVERY

Location Sketch:



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Signature: ____ Xerox: ____
BORING LOG GENERAL DATA
Borehole Number: ____

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WELL CONSTRUCTION LOG

Site ID:
Well Number: E3-P13-M04
Job Number:
Today's Date: 8/2/93
Well Start/Completion Dates: 8/2, 8/2

Installation Difficulties:

Remarks:

Check as appropriate, record depths as below ground surface (BGS)

Screen:

Manufacturer: BEDROCK ENTERPRISES INC
Schedule: 40
Type: Continuous Slot ~~#~~ HORIZONTAL SLOT
Perforated
Louvre
Other

Materials: Stainless Steel
PVC ✓
Other

Length: 10'
Screened Interval: ~~8-18.6~~ 8.6-18.6'
Diameter: (ID) 4.0" (OD) 4.5"
Thickness: 1/4"
Slot: Size (inches): .020" Configuration: HORIZONTAL SLOT
Open Area per Foot of Screen: 6.27 in²/ft

Casing

Manufacturer: BEDROCK ENTERPRISES
Schedule: 40
Material: Stainless Steel
PVC X
Other
Length: 10 FEET
Diameter: (ID) 4.0" (OD) 4.5"
Thickness: .25"
Joint(s): Design THREDED
Composition PVC
Depth(s) 8.6

Centralizer: Design N/A
Composition
Depth(s)

Solvent, Glues, Cleaners: Manufacturer N/A
Use(s)

Protective Casing: Material HARDENED STEEL
Inner Diameter 6"

Sent to USATHAMA:
Date Sent:
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Signature:
WELL CONSTRUCTION LOG
Well Number: E3-P13-M04
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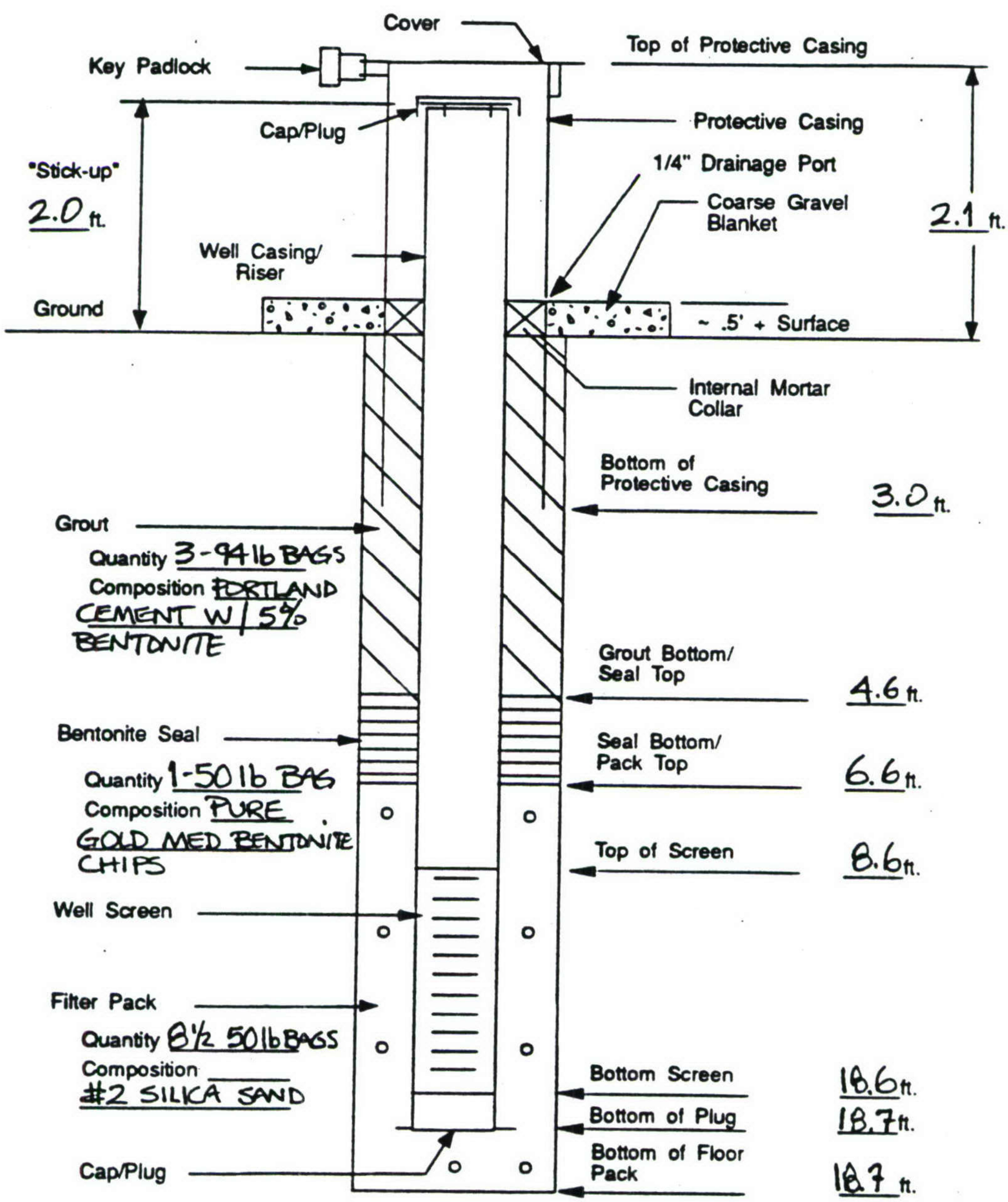
Well Construction Log:

Site ID Number: P13

Well Number: E3-P13-M04

Today's Date: 8/2/93

WELL CONSTRUCTION



Project: SUDBURY ANNEX | Boring: E3-P13-M04 | Page: 3 of 4

8/2/93

START/FINISH — 1618/1855

GROUND SURFACE

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		SS1 0-2' YELLOW-BROWN SILTY SAND MINOR MED SAND (<5%)	R=.5' 1620	6 6 5 6 6	NOTE: 1/ SPLIT SPOON DRIVEN W/ 140 LB HAMMER W/ 30" FREE FALL 2/ DEPTHS IN FT 3/ R IN FEET 4/ 8 1/4" HSA 5/ 2"x2' SPLIT SP
		0.0 ppm OVA			
2					
4		SS2 TAN MED GR SND, MOIST TO VERY MOIST AT BOTTOM OF SPOON <10% CS QR, 2 FE BANDS @ 5.5'	R=1.1 1652	5 6 7 7	
		OVA 0.0 ppm			DRILLING NOTES 1/ DRIVE SPL SP 0-2 2/ AUGER TO 4' 3/ DRIVE SS 4-6' 4/ AUGER TO 9' 5/ H_2O = 9' 6/ DRIVE SS 9-11 7/ AUGER TO 14' 8/ DRIVE SS 14'-16' 9/ AUGER TO 18' 10/ INSTALL SCREEN 8-18'
6	▽				
9	9	TOP OF SPOON WET CS GRAINED SAND W/ GRAVEL QTZ ITE, PHYLLITES .3-1.2 FT = WET GREY ~~CLAY~~ SILT W/CLAY TIGHT, PLASTIC, HOMOGENEOUS	R-1.2 1700	6 6 8 8	
		0.0 ppm OVA SS-3			
11	11				
14		FN GRAINED, WET, GREY SAND ~~WET~~ HOMOGENEOUS	1710 R=.4	3 3 4 3	
		OVA = 0.0 ppm SS4			
16					SAMPLE 9-11' BX13G4X1
18		TD = 18'			

BORING LOG GENERAL DATA
Borehole Number: ______ Page: 2 of ______ Signature: ______ Xerox: ______ Sent to USATHAMA: ______ Date Sent: ______

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BORING LOG GENERAL DATA

4 4

Project: Sudbury Annex | Boring: E3-P13-MC4 | Page: 1 of 1

Driller & Company: MARK THIBODEAU / ENVIRONMENTAL STRUCTURAL DRILLING

Geologist/Logger & Company: W.GRAF / E&E | Signature: Walter Graf

Date Boring Started: 8/2/93 | Completed: 8/2/93

Water Levels (from Ground Surface) | Drilling Rig: Ingersoll-Rand A-300

First Encountered: ≈ 9 | Date: 8/2/93

While Drilling: ≈ 9 | Date: 8/2/93

At Boring Completion: 9 | Date: 8/2/93

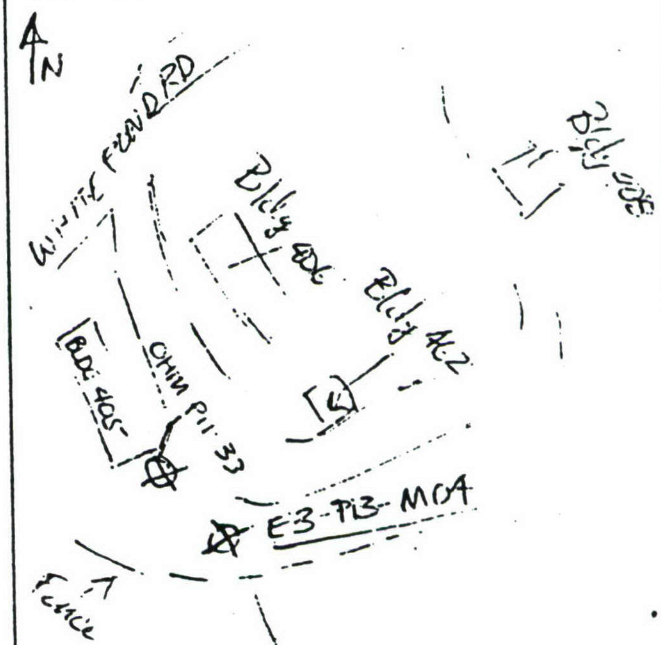
Drilling Shifts:

Date	Time		Depth of Drilling Per Shift		Date	Time		Depth of Drilling Per Shift	
	Start	End	Start	End		Start	End	Start	End
8/2/93	1618	1555	0	18.6					

Abbreviations:

Abbr.	Meaning
SPL SP	SPLIT SPOON
R =	RECOVERY

Location Sketch:



Sent to USATHAMA: ______ Date Sent: ______

Page: 1 of ______ Xerox: ______

Signature: Walter Graf

BORING LOG GENERAL DATA

Borehole Number: E3-P13-MC4

usagndat.pm4

WATERSHED 2

GROUNDWATER MONITORING WELLS

E3-P36-M01
E3-P36-M02
E3-P36-M03
E3-P37-M01
E3-P37-M02
E3-P37-M03

WELL CONSTRUCTION LOG

Site ID: SUDBURY ANNEX
Well Number: E3 P36-M01
Job Number:
Today's Date: 8/5/93
Well Start/Completion Dates:
SAME AS ABOVE

Installation Difficulties:

Remarks:

Check as appropriate, record depths as below ground surface (BGS)

Screen:

Manufacturer: BEDROCK ENTERPRISES, INC
Schedule: 40
Type: Continuous Slot HORIZONTAL 1/4" SPACING
Perforated
Louvre
Other

Materials: Stainless Steel
PVC X
Other

Length: 10'
Screened Interval: 8-18'
Diameter: (ID) 4.0" (OD) 4.5"
Thickness: .25"
Slot: Size (inches): .020" Configuration: HORIZONTAL SLOT
Open Area per Foot of Screen: 6.27 in²/ft

Casing

Manufacturer: BEDROCK ENTERPRISES INC.
Schedule: 40
Material: Stainless Steel
PVC X
Other
Length: 1
Diameter: (ID) 4.0" (OD) 4.5"

Thickness: .25"

Joint(s): Design THREADED
Composition PVC
Depth(s) 8.0'

Centralizer: Design N/A
Composition
Depth(s)

Solvent, Glues, Cleaners: Manufacturer NONE
Use(s)

Protective Casing: Material HARDENED STEEL
Inner Diameter 6.0"

usainfo cdr

Sent to USATHAMA: Date Sent:
Page 1 of 3 Xerox:
Signature:

WELL CONSTRUCTION LOG
Well Number:

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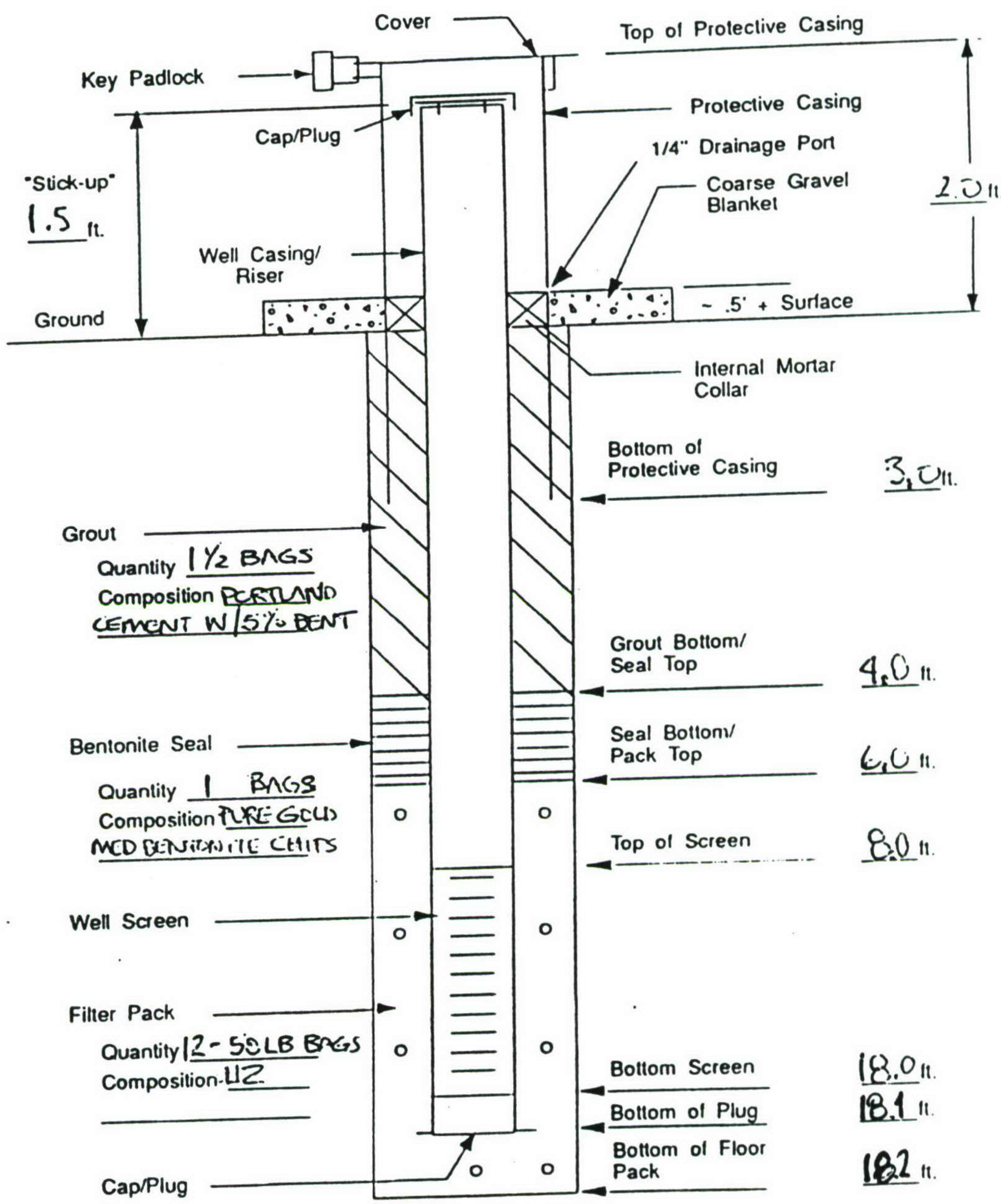
Well Construction Log:
Site ID Number: P36
Well Number: E3 - P36 - M01
Today's Date: 8/5/93

WELL CONSTRUCTION



WELL CONSTRUCTION LOG Page 2 of 3 Sent to USATHAMA: ______
Well Number: ______ Signature: ______ Xerox: ______ Date Sent: ______

Project: SUDBURY ANNEX	Boring: E3 P36 M01	Page: 3 of 4

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	8/5/93 Soil/Rock Description START/COMPLETE - 1415/1635	Sample Number & Depth	Blow Count & Recovery	Drilling Data
GROUND SURFACE					
		SS1 - DRY, TIGHT ~~TAN~~/~~YEL TAN~~/ YELLOW/BROWN SILT W/SAND WEATHERED PHYLITE @ ≈ 2'	1425 R=1.6	4 15 21 30	NOTES: 1) SPLIT SPOONS DRIVEN W/ 140LB HAMMER W/ 30" FREEFALL
		OVA = 0.0 ppm			2) DEPTH & "R" IN FEET
2	2				3) 8¼ HSAs
4	4	SS2 TAN, DRY, TIGHT SILTY CLAY W/ WEATHERED ROCK FRAGMENTS & GRAVEL (SUBROUNDED) SOME FE STAINING.	1443 R=1.5	19 26 20 15	4) 2" x 2' SPLIT SPOONS
6	6				DRILLING NOTES
9	▽	H_2O ≈ 9.0' TAN, WET TIGHT SILTY CLAY W/ WEATHERED ROCK AS ABOVE. TILL) APPROX 30% OF SPOON SHOWS FE STAINING FROM PHYLITE	1505 R=1.0	15 26 37 73	1) AUGER THROUGH ASPHALT 2) DRIVE SPLIT SP 0-2' 3) AUGER TO 4' 4) DRIVE SPLIT SP 4-6' 5) AUGER TO 9'. DIFFICULT COBBLES OR BOULDERS ENCOUNTERED
11					
14		SS4 - TAN, WET SILTY CLAY W/ WEATHERED ROCK AS ABOVE. FE STAINING FROM WEATHERED PHYLLITES.	1525 R=1.5	20 31 50 43	6) DRIVE SPL SP 9-11 7) H_2O @ ≈ 9.0' 8) AUGER TO 14' 9) DRIVE SPLIT SPOON 14-16' 10) AUGER TO 18'
16		TD - 18.0'			SAMPLE 9-11' BX3601X1

usagndat.pm4

BORING LOG GENERAL DATA
Borehole Number: E3-P36-M01
Page: 2 of
Signature:
Sent to USATHAMA:
Xerox:
Date Sent:
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recycled paper

ecology and environment

BORING LOG GENERAL DATA

Project: SUDBURY ANNEX | Boring: E3-P36-M01 | Page: 1 of 4

Driller & Company: MARK THIBODEAU / ES

Geologist/Logger & Company: W. GRAF / E&E | Signature: Walter Graf

Date Boring Started: 8/5/93 | Completed: 8/5/93

Water Levels (from Ground Surface) | Drilling Rig: INGERSOLL RAND A-302

First Encountered: 9' | Date: 8/5/93

While Drilling: 9' | Date: 8/5/93

At Boring Completion: 9.0' | Date: 8/5/93

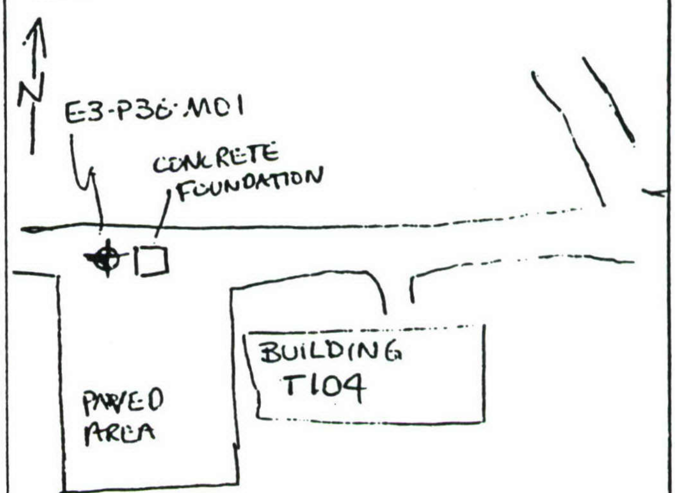
Drilling Shifts:

Date	Time		Depth of Drilling Per Shift		Date	Time		Depth of Drilling Per Shift	
	Start	End	Start	End		Start	End	Start	End
8/5/93	1415	1635	0	18'					

Abbreviations:

Abbr.	Meaning
SPL SP	SPLIT SPOON
R	RECOVERY

Location Sketch:



usagndat.pm4

BORING LOG GENERAL DATA
Borehole Number: ____ Page: 1 of ____ Signature: ____ Xerox: ____ Sent to USATHAMA: ____ Date Sent: ____

58

WELL CONSTRUCTION LOG

Site ID: SUDBURY ANNEX
Well Number: E3-P36-M02
Job Number:
Today's Date: 8/6/93
Well Start/Completion Dates: 8/6/93

Installation Difficulties:

Remarks:

Check as appropriate, record depths as below ground surface (BGS)

Screen:

Manufacturer: BEDROCK ENTERPRISES INC
Schedule: 40
Type: Continuous Slot HORIZONTAL 1/4" SPACING
Perforated
Louvre
Other

Materials: Stainless Steel
PVC X
Other

Length: 10'
Screened Interval: 8-18'
Diameter: (ID) 4.0" (OD) 4.5"
Thickness: .25"
Slot: Size (inches): .020 Configuration: HORIZONTAL SLOT
Open Area per Foot of Screen: 6.27 in²

Casing

Manufacturer: BEDROCK ENTERPRISES
Schedule: 40
Material: Stainless Steel
PVC X
Other

Length: 10'
Diameter: (ID) 4.0" (OD) 4.5"

Thickness: .25"

Joint(s): Design THREADED
Composition PVC
Depth(s) 8.0

Centralizer: Design N/A
Composition
Depth(s)

Solvent, Glues, Cleaners: Manufacturer NONE
Use(s)

Protective Casing: Material HARDENED STEEL
Inner Diameter 6.0"

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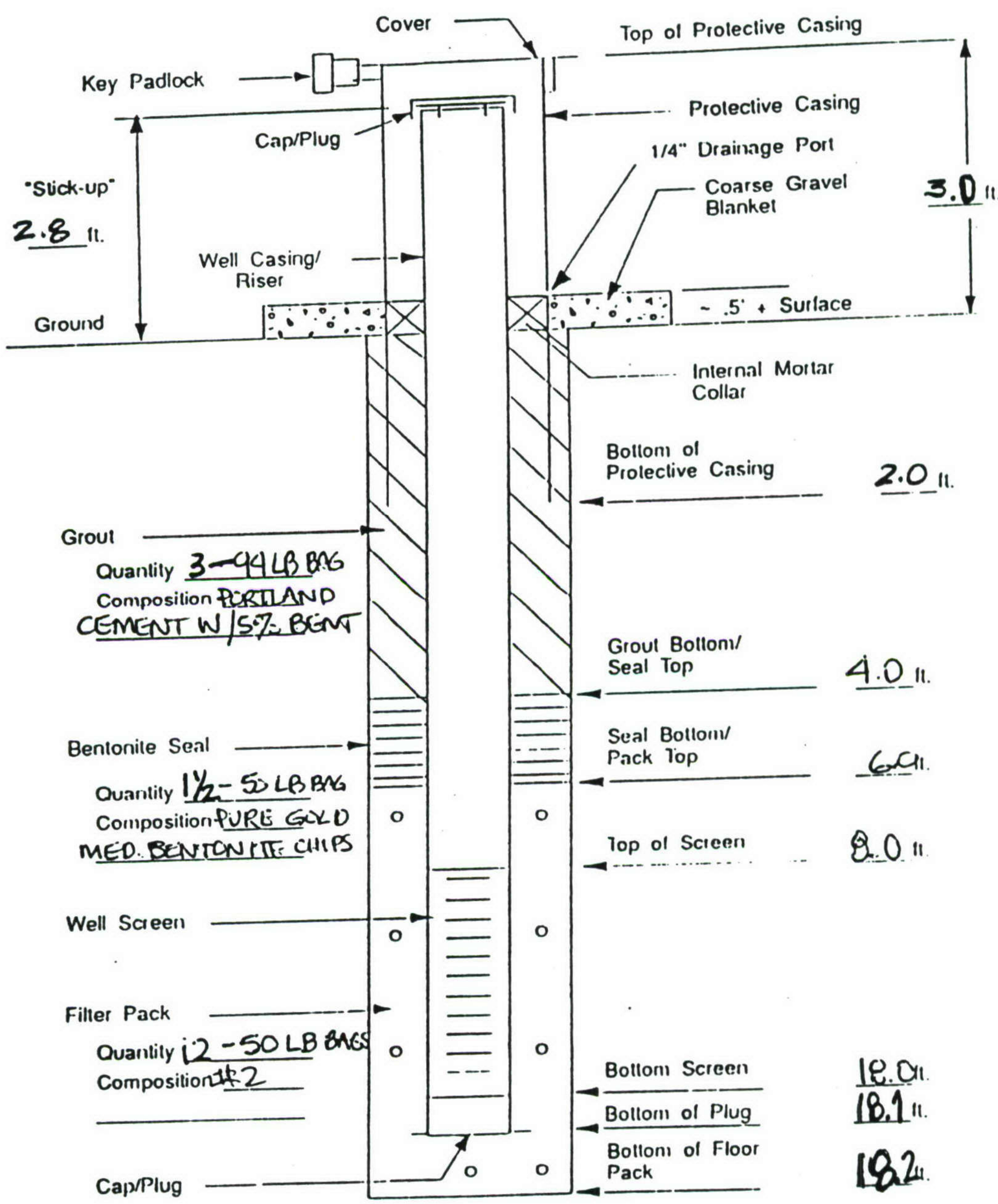
Sent to USATHAMA:
Date Sent:
Xerox:
Page 1 of 3
Signature:
WELL CONSTRUCTION LOG
Well Number:
74

Well Construction Log:
Site ID Number: P36
Well Number: E3-P36-MO2
Today's Date: 8/6/93

WELL CONSTRUCTION



WELL CONSTRUCTION LOG
Well Number: E3 P36 MO2
Page 2 of 3
Signature: Walter Gray
Xerox:
Sent to USATHAMA:
Date Sent:

BORING LOG GENERAL DATA

Project: SUDBURY ANNEX Boring: E3-P36-M02 Page: 3 of 4

Driller & Company: MARK THIBODEAU

Geologist/Logger & Company: W GRAF / E&E Signature: Walter Graf

Date Boring Started: 8/6/93 Completed: 8/6/93

Water Levels (from Ground Surface) Drilling Rig: INGERSOLL RAND A 300

First Encountered: 10' Date: 8/6/93

While Drilling: 10' Date: 8/6/93

At Boring Completion: 10' Date: 8/6/93

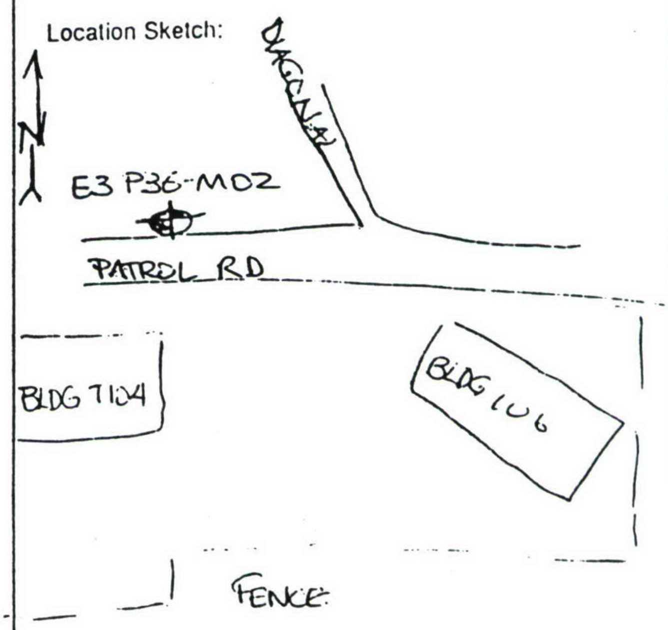
Drilling Shifts:

Date	Time		Depth of Drilling Per Shift		Date	Time		Depth of Drilling Per Shift	
	Start	End	Start	End		Start	End	Start	End
8/6	1102		0	18.0'					

Abbreviations:

Abbr.	Meaning
SPL SP	SPLIT SPOON
R	RECOVERY

Location Sketch:



BORING LOG GENERAL DATA
Borehole Number: ______
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Signature: ______
Sent to USATHAMA: ______
Xerox: ______
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BORING LOG GENERAL DATA
Borehole Number: E3-P36-M02
Page: 2 of
Signature: Walter Grey
Xerox:
Sent to USATHAMA:
Date Sent:
33

Project: SUDBURY ANNEX

Boring: E3-P36-M02

8/6/93

START/FINISH - 1102/

GROUND SURFACE

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		~~SS1~~ - DRY, TAN YELLOW FN-MED GRAINED SAND, LOOSE, SOME COARSE GRAINS FN/MD/CS = 30/60/10. OVA = 0.0 ppm	SS1 1103 R=1.0	7 7 9 11	NOTE: 1/ SPLIT SPOONS ARE DRIVEN W/ 140 LB HAMMER W/ 30" FREEFALL 2/ DEPTH & R IN FEET 3/ 8¼" HSAs 4/ 2" X 2' SPLIT SPOONS
2					
4		~~DRY~~, TAN, MOIST. MED/CS GRAINED SAND, LOOSE FN/MED/CS = 10/40/50 NO GRAVEL. OVA = 0.0 ppm	SS2 1111 R=1.5	5 4 6 8	
6		TIGHT			DRILLING NOTES 1/ DRIVE SPL SP 0-2'
9		MOIST, TAN, SANDY SILT W/ WEATHERED GRAVEL BECOMING WET @ 10'. SAND MED/FN GR SND/SILT 20/80. GRAVEL IS WEATHERED GRANODIORITE, QTZ/QTZITE PHYLLITE. OVA = 0.0 ppm	SS3 1127 R=.9	19 18 17 13	2/ AUGER TO 4' 3/ DRIVE SPL SP 4-6'
10	▽				4/ AUGER TO 9' - ENCOUNTERED COBBLES DRILLING SLOW 5/ DRIVE SPLIT SPOON 9-11'
11					6/ H_2O @ ≈ 10' 7/ AUGER TO 14'
14		WET GREY SANDY SILT W/ GRAVEL FN/GR SND/SILT = 20/40% GRAVEL - WEATHERED, SUBROUNDED QTZ/QTZITE, GRANODIORITE, PHYLLITE SOME FE BANDING, STAINS. OVA = 0.0 ppm	SS4 1147 R=1.3	9 9 11 11	8/ DRIVE SPL SP 14-16' 9/ AUGER TO 18' (TD) 10/ INSTALL MW
16		TD = 18.0'			
19					SAMPLE 9-11 BX3602X1
21					

usagodal.pm4

WELL CONSTRUCTION LOG

Site ID:
Well Number: E3-P36-M03
Job Number:
Today's Date: 8/7/93
Well Start/Completion Dates:
8/7/93

Installation Difficulties:

Remarks:

Check as appropriate, record depths as below ground surface (BGS)

Screen:

Manufacturer: BEDROCK ENTERPRISES, INC
Schedule: 40
Type: Continuous Slot HORIZONTAL 1/4" SPACING
Perforated
Louvre
Other

Materials: Stainless Steel
PVC X
Other

Length: 10'
Screened Interval: 9-19.0'
Diameter: (ID) 4.0" (OD) 4.5"
Thickness: .25"
Slot: Size (inches): .020" Configuration: HORIZONTAL SLOT
Open Area per Foot of Screen: 627 in²/ft

Casing

Manufacturer: BEDROCK ENTERPRISES, INC
Schedule: 40
Material: Stainless Steel
PVC X
Other
Length: 10'
Diameter: (ID) 4.0" (OD) 4.5"

Thickness: .25"

Joint(s): Design THREADED
Composition PVC
Depth(s) 9.0'

Centralizer: Design NA
Composition
Depth(s)

Solvent, Glues, Cleaners: Manufacturer NONE
Use(s)

Protective Casing: Material HARDENED STEEL
Inner Diameter 6"

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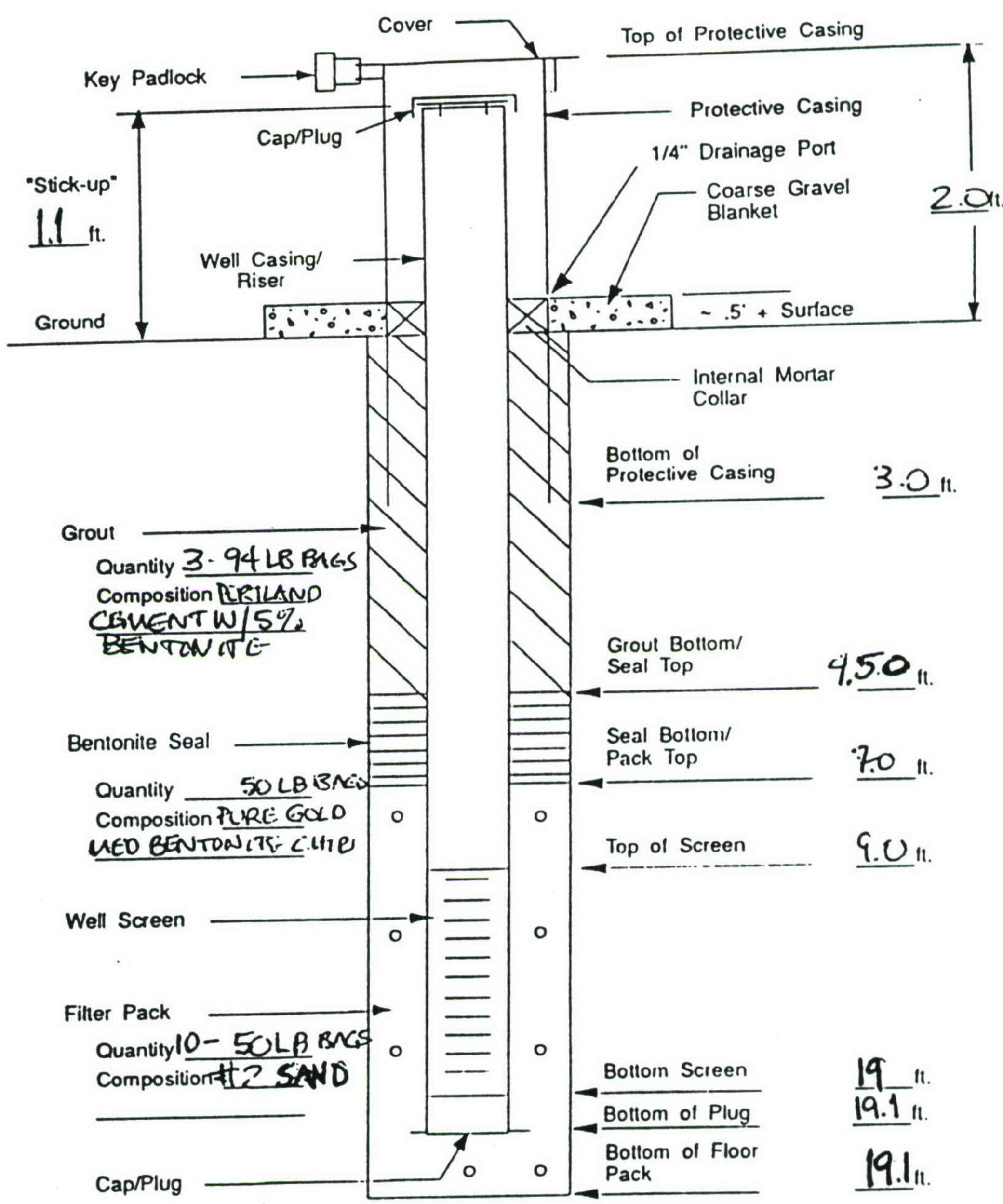
Sent to USATHAMA:
Date Sent:

Page 1 of 3 Xerox:
Signature: [signature]

WELL CONSTRUCTION LOG
Well Number: E3-P36-M03
74

Well Construction Log: ______
Site ID Number: P36
Well Number: E3 P36-M03
Today's Date: 8/7/93

WELL CONSTRUCTION



Sent to USATHAMA: ______
Date Sent: ______

Page 2 of 3 Xerox: ______
Signature: ______

WELL CONSTRUCTION LOG
Well Number: E3-P36-M03

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Project: SUDBURY ANNEX

Boring: E3-P36-M03

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		8/7/93 START / FINISH 1002 / 1250 GROUND SURFACE		3	NOTE:
		SS1- DRY, LIGHT BROWN MD/CS SAND W/GRAVEL, LOOSE GRAVEL SUBROUNDED GRANODIORITE, QTZ, WHITE PHYLLITES. OVA 0.0 ppm	1004 R=.5	6 8 11	1/ SPLIT SPOONS ARE DRIVEN W/ 140 LB HAMMER W/ 30" FREEFALL
2					2/ DEPTH & R IN FEET
4		4.0-4.2' MOIST, TAN, MED/CS GRAIN SAND W/GRAVEL GRADING TO GRAVELLY SAND MOIST W/FINES BECOMING MORE ABUNDANT. 5.7→6.0' TAN MOIST FN GRAINED SAND HOMOGENEOUS	SS2 1034 R=1.1	2 6 7 7	3/ HSAs 4/ 2" X 2' SPLIT SPOONS
6					DRILLING NOTES 1/ DRIVE SPL SP 0-2'
9		9.0→9.3 MED/CS GR SAND W/GRAVEL MOIST 9.3-9.6 100% GREY FN GR SAND, MOIST HOMOGENEOUS 9.6→9.8 - FN/MED/CS GR. GRAVELLY SAND GRAVEL WEATHERED GRANODIORITE QTZ PHYLLITES. OUTWASH 9.8→100% FN GR. SAND GREY MOIST	SS3 1045 R=1.5	4 5 7 7	2/ AUGER TO 4' 3/ DRIVE SPLSP 4-6 4/ AUGER TO 9' 5/ DR SPLIT SPOON 9-11'
11	▽	H_2O @ ≈ 13'			6/ AUGER TO 14' 7/ H_2O ≈ 13.0'
14		FN GRAINED GREY WET SAND GRADING TO CS GRAINED SAND W/MED & FINES AND GRAVEL (14.5-15.5) 15.5'+ FN GRAINED SILTY ~~SAND~~ LOS W/ CLAY, PLASTIC, GREY BROWN	SS4 1056 R=1.2	4 4 7 10	8/ DRIVE SPL. SP 14-16' 9/ AUGER TO 19' TD: 19.1'
16					SAMPLES 14-16' BX3603X1
			R=		

BO. G LOG GENERAL DATA
Borehole Number: E3-P36-M03
Page: 2 of
Signature: [signature] X
Sent to USATHAMA:
Date Sent:

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BORING LOG GENERAL DATA

Project: SUDBURY ANNEX   Boring: E3-P36-M03   Page: 4 of 4

Driller & Company: DAVE / ESD

Geologist/Logger & Company: W. GRAF / E&E   Signature: Walter Graf

Date Boring Started: 8/7/93   Completed: 8/7/93

Water Levels (from Ground Surface)   Drilling Rig: INGERSOLL RAND A-300

First Encountered: 13.0   Date: 8/7/93

While Drilling: 13.0   Date: 8/7/93

At Boring Completion: 13.0'   Date: 8/7/93

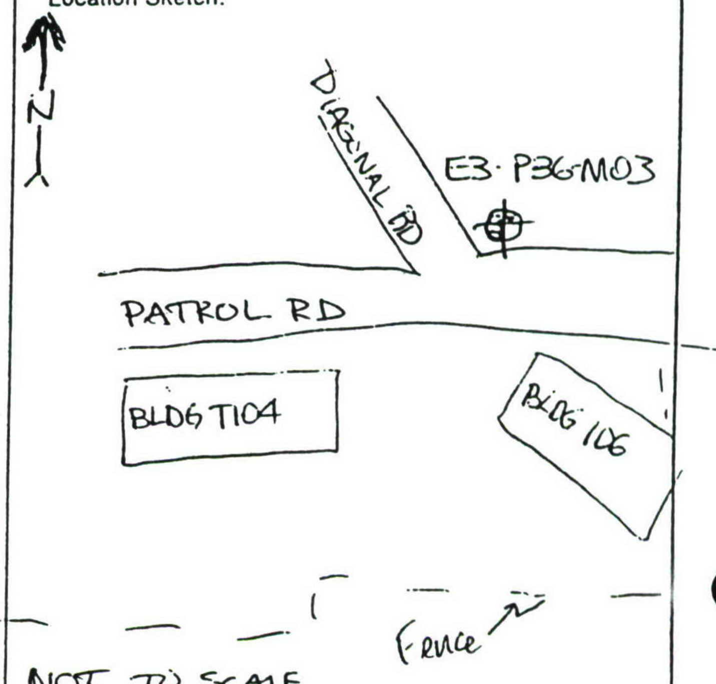
Drilling Shifts:

Date	Time		Depth of Drilling Per Shift		Date	Time		Depth of Drilling Per Shift	
	Start	End	Start	End		Start	End	Start	End
8/7/93	1002	1250	0	19.1					

Abbreviations:

Abbr.	Meaning
SPL SP	SPLIT SPOON
R	RECOVERY

Location Sketch:



BORING LOG GENERAL DATA
Borehole Number: ______
Page: 1 of ______
Signature: ______
Xerox: ______
Sent to USATHAMA: ______
Date Sent: ______
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usagndat.pm4

WELL CONSTRUCTION LOG

Site ID: SUDBURY ANNEX
Well Number: E3-P37-M01
Job Number:
Today's Date: 8/6/93
Well Start/Completion Dates: 8/6/93

Installation Difficulties:

Remarks:

Check as appropriate, record depths as below ground surface (BGS)

Screen:

Manufacturer: BEDROCK ENTERPRISES, INC
Schedule: 40
Type: Continuous Slot HORIZONTAL SLOT 1/4" SPACING
Perforated
Louvre
Other

Materials: Stainless Steel
PVC X
Other

Length: 10'
Screened Interval: 9.5 – 19.5'
Diameter: (ID) 4.0" (OD) 4.5"
Thickness: .25"
Slot: Size (inches): .020" Configuration: HORIZONTAL SLOT
Open Area per Foot of Screen: 6.27 in²/ft

Casing

Manufacturer: BEDROCK ENTERPRISES, INC
Schedule: 40
Material: Stainless Steel
PVC X
Other

Length: 10'
Diameter: (ID) 4.0" (OD) 4.5"

Thickness: .25"

Joint(s): Design THREADED
Composition
Depth(s)

Centralizer: Design N/A
Composition
Depth(s)

Solvent, Glues, Cleaners: Manufacturer NONE
Use(s)

Protective Casing: Material HARDENED STEEL
Inner Diameter 6.0"

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WELL CONSTRUCTION LOG
Well Number:
Page 1 of 3
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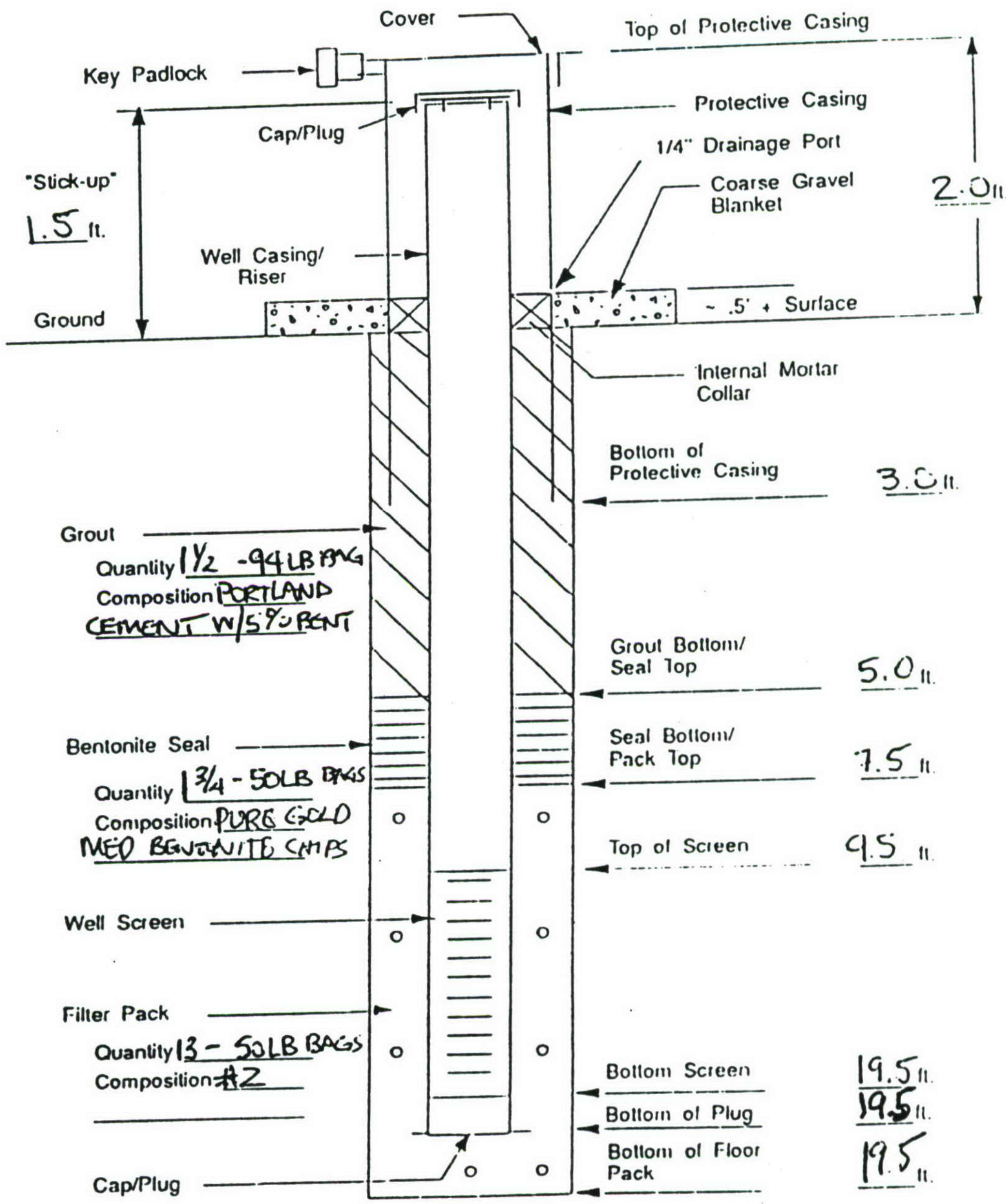
Well Construction Log:

Site ID Number: P37

Well Number: E3-P37 M01

Today's Date: 8/6/93

WELL CONSTRUCTION



WELL CONSTRUCTION LOG

Well Number: E3-P36-M01

Page 2 of 3 Xerox:

Signature: [signature]

Sent to USATHAMA:

Date Sent:

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usaiplo2.cdr

Project: SUDBURY ANNEX

Boring: E3-P37-M01

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	8/6/93 Soil/Rock Description START/FINISH - 0820/1025 GROUND SURFACE	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		SS1 - DRY YELLOW BR - MED/CS SAND W GRAVEL - LOOSE FN/MD/CS = 20/50/30 ; SND/GRAVEL 80/30. GRAVEL SUBROUNDED QTZ GRANODIORITE, PHYLITE OVA - 0.0ppm	0824 R: 1.2	3 6 7 6	NOTE: 1/SPLIT SPOONS DRIVEN W/140LB HAMMER W/ 30" FREE FALL 2/DEPTH & "R" IN FEET 3/8¼" HSA 4/2"x2' SPLIT SPOON
2					
4		SS2 - TAN, MOIST, MED/CS GRAINED SAND, MINOR GRAVEL <10% FN/MD/CS = 10/40/50. GRAVEL SUBROUNDED QTZ, GRANODIORITE, PHYLITE LOOSELY COMPACTED OVA 0.0 ppm	0833 R: 1.1	3 4 6 7	DRILLING NOTES 1/DRIVE SPL SP 0-2 2/AUGER TO 4' 3/DRIVE SPLIT SP 4-6'
6					
9		SS3 9-10' SAND AS ABOVE 10-11' CS GR SAND BED W/GRAVEL FE STAINING. FINES INCREASING @ 11' FN/MD/CS = 10/30/60. GRAVEL SUBROUNDED QTZ, GRANODIORITE PHYLITE, WEATHERED OVA 0.0 ppm	0844 R: 1.7	3 4 11 24	4/AUGER TO 9' 5/DRIVE SPLIT SPOON 9-11' 6/AUGER TO 14' 7/ $H_2O \approx 12.0'$ 8/DR. SPL SP 14-16 9/AUGER TO 19 10/DRIVE SPLIT SP 19-21' 11/INSTALL MW
11	▽	$H_2O \approx 12.0'$			
14		SS4 GREY, WET, SANDY SILT W/WEATHERED GRAVEL, TIGHT SOME FE STAINS. GRAVEL SUBROUNDED QTZ, GRANODIORITE, PHYLITE, MAFICS. TILL OVA = 0.0 ppm	0905 R: 1.1	13 16 17 28	
16				10 53 54 73	
19		SS4 19-20.5 BROWN, WET, TIGHT SILT W/MINOR SND, GRAVELS HEAVILY WEATHERED. 20.5 - 21' GREY, TIGHT SILTY CLAY. GRAVEL <10%. WEATHERED QTZ/QTZITE, GRANODIORITE PHYLLITE	0925 R: 1.5		SAMPLES 14-16 BX3701X1
21		TD = 19.5'			

usagndal pm4

BORING LOG GENERAL DATA Page: 2 of

Borehole Number: E3-P37-M01 Signature:

Sent to USATHAMA: Date Sent:

Xerox:

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ecology and environment

BORING LOG GENERAL DATA

Project: SUDBURY ANNEX Boring: E3 P37-M01 Page: ~~1~~ 4 of 4

Driller & Company: MARK THIBODEAU | ESD

Geologist/Logger & Company: W. GRAF | E&E Signature: Walter Graf

Date Boring Started: 8/6/93 Completed: 8/6/93

Water Levels (from Ground Surface) Drilling Rig: INGERSOLL RAND A-300

First Encountered: ≈12.0' Date: 8/6/93

While Drilling: ≈12.0' Date: 8/6/93

At Boring Completion: 12.0 Date: 8/6/93

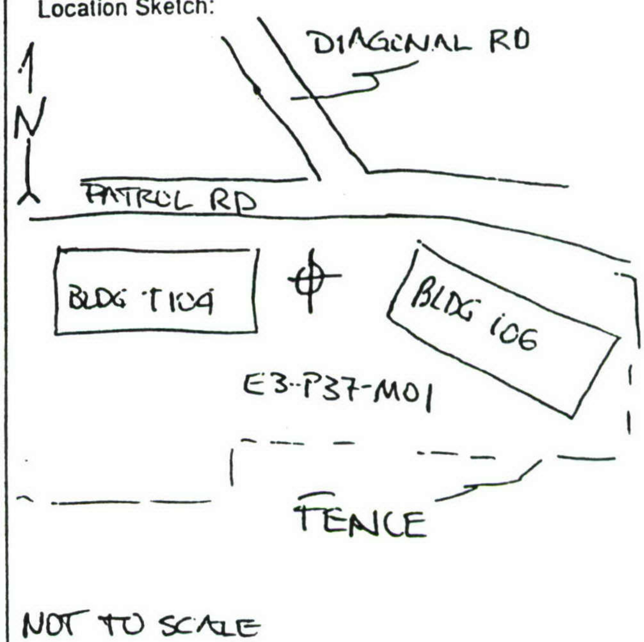
Drilling Shifts:

Date	Time		Depth of Drilling Per Shift		Date	Time		Depth of Drilling Per Shift	
	Start	End	Start	End		Start	End	Start	End
8/6	0820	1025	0	19.5'					

Abbreviations:

Abbr.	Meaning
SPL SP	SPLIT SPOON
R=	RECOVERY

Location Sketch:



Page: 1 of
Signature: Walter Graf
Xerox:
Sent to USATHAMA:
Date Sent:
... LOG GENERAL DATA
Borehole Number: E3-P37-M01
8

usagndat.pm4

CONSTRUCTION

ID: SUDBURY

Number: E

Lot Number:

Today's Date: 8/7/93

Well Start/Completion Dates: 8/7/93, 8/7/93

Rema

as appropriate, record below ground surface

Screen:

Manufacturer: BEDROCK ENTERPRISES, INC.

Schedule: 40

Type: Continuous Slot
Perforated
Louvre
Other

Material: Stainless Steel
PVC
Other

Length: 10'

Screen Interval: 9-

Diameter: (ID) 4.0" (OD)

Thickness: .25

Slot Size (inches) .020 Configuration:

Open Area per Foot of Screen:

Casing:

Manufacturer: BEDROCK ENTERPRISES, INC.

Schedule: 40

Material: Stainless Steel
PVC
Other

Length: 10'

Diameter: (ID) 4.0" (OD)

Thickness: .25

Composition
Depth(s)

Design
Composition
Depth(s)

Clear

Casing

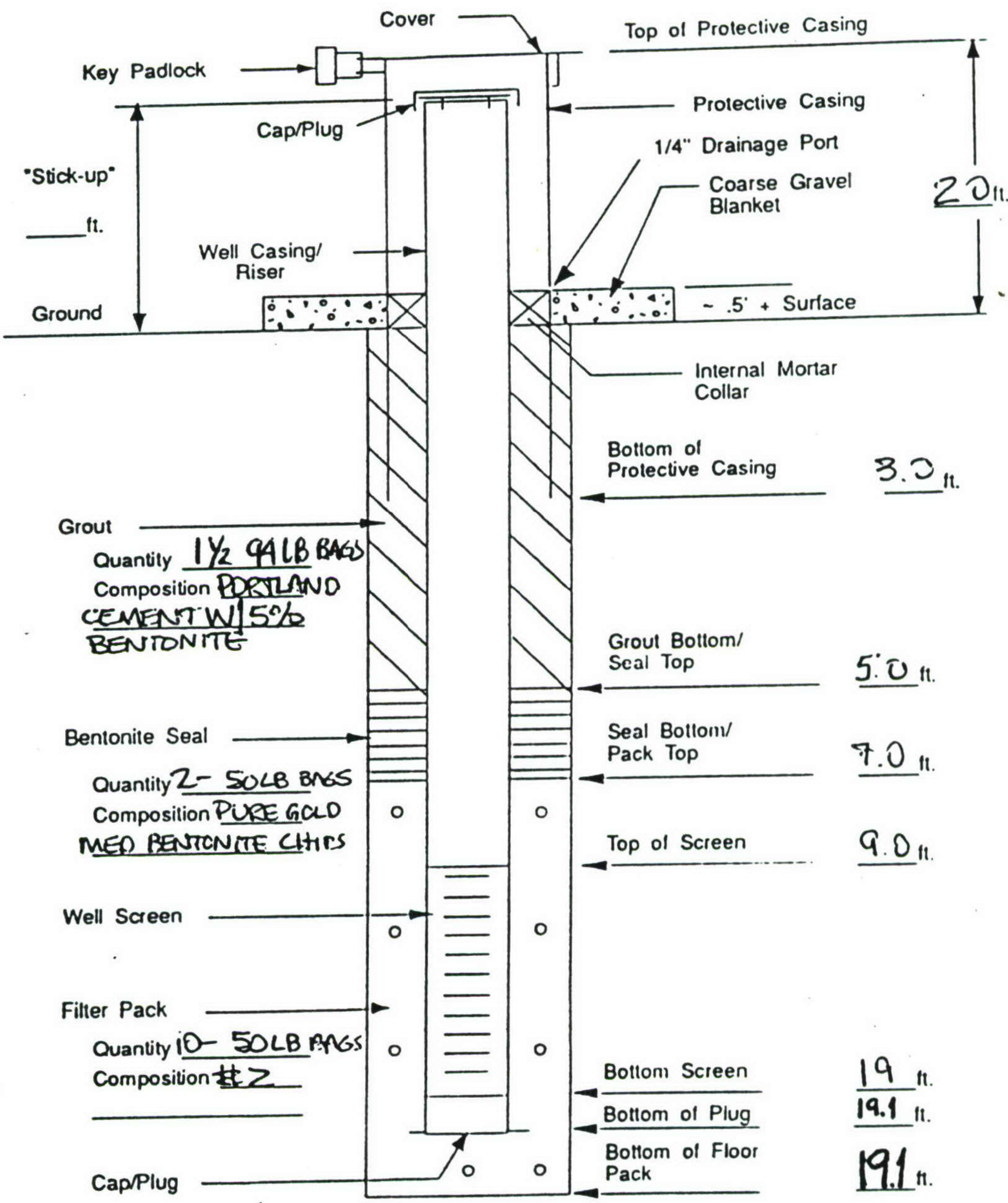
Sent to: HOATHAMA:

Page 1 of

Signature:

Well Construction Log:
Site ID Number: P37
Well Number: E3-P37-M02
Today's Date: 8/7/93

WELL CONSTRUCTION



WELL CONSTRUCTION LOG
Well Number: E3-P37-M02
Page 2 of 3
Signature: Walter Gro
Xerox:
Sent to USATHAMA:
Date Sent:

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Boring: E3-~~P37~~-M02

Project: SUDBURY ANNEX

8/7/93

START/FINISH - 1307/1455

Depth/Elevation (Ft.)	USCS Symbol/Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		GROUND SURFACE			
		BROWN, MOIST, GRAVELLY LOOSE SAND. FN/MED/CS = 20/40/40. GRAVEL SUBROUNDED QTZITE, GRANODIORITE, PHYLLITES. OVA-0.0ppm	SS1 1310 R:1.1	4 4 5 7	NOTE: 1/ SPLIT SPOONS ARE DRIVEN W/ 140 LB HAMMER W/ 30" FREEFALL 2/ DEPTH & R IN FEET 3/ 6¼" HSAs 4/ 2" X 2' SPLIT SPOONS
2					
4		4-5.5' MOIST, TAN, LOOSE MED/CS GRAINED SAND W/ WEATHERED GRAVEL OF PHYLLITE, GRANODIORITE, QTZITE, SOME FE STAINING. 5.5-6.0 FN/MED GRAINED SAND, MOIST, LOOSE, MINOR FE STAINS, NO GRAVEL FN/MED = 30/70. OVA = 0.0ppm	SS2 1325 R: 1.2	3 5 6 6	
6					DRILLING NOTES 1/ DRIVE SPL SP 0-2'
9		100% FN GRAINED SAND, GREY, MOIST, SOME FE STAINS, NO GRAVEL, LOOSE. OVA-0.0ppm	SS3 1340 R:1.4	3 4 5 5	2/ AUGER TO 4' 3/ DRIVE SPLIT SP 4-6' 4/ AUGER TO 9' 5/ DRIVE SPLIT SP. 9-11' 6/ AUGER TO 14'
11					7/ DRIVE SPL SP 14-16'
14	▽	H_2O @ 14.0' 14-14.5 WET, BROWN, SAND W/GRAVEL FN/MD/CS = 30/50/20. GRAVEL SUBROUNDED. 14.5-16.0 - 100% GREY SANDY SILT W/CLAY AT BOTTOM OF SPOON PLASTIC. OVA - 0.0ppm	SS4 1400 R=1.7	2 2 2 3	8/ H_2O @ 14.0' 9/ DRIVE SPL SP 14-16 10/ AUGER TO 19' 11/ TD = 19.0'
16		TD = 19.0'			SAMPLE 14-16'- BX3702X1
19	TD				

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Sent to USATHAMA: ____ Date Sent: ____

Page: 2 of ____ Signature: [signature] XXXX: ____

BORING LOG GENERAL DATA
Borehole Number: E3-~~P37~~-M02

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ecology and environment

BORING LOG GENERAL DATA 4

Project: SUDBURY ANNEX Boring: E3-P37-M03 Page: 3 of 4

Driller & Company: DAVE

Geologist/Logger & Company: W. GRAF | E&E Signature: Walter Graf

Date Boring Started: 8/7/93 Completed: 8/7/93

Water Levels (from Ground Surface) Drilling Rig: INGERSOLL RAND A-300

First Encountered: 14.0 Date: 8/7

While Drilling: 14.0 Date: 8/7

At Boring Completion: 14.0 Date: 8/7

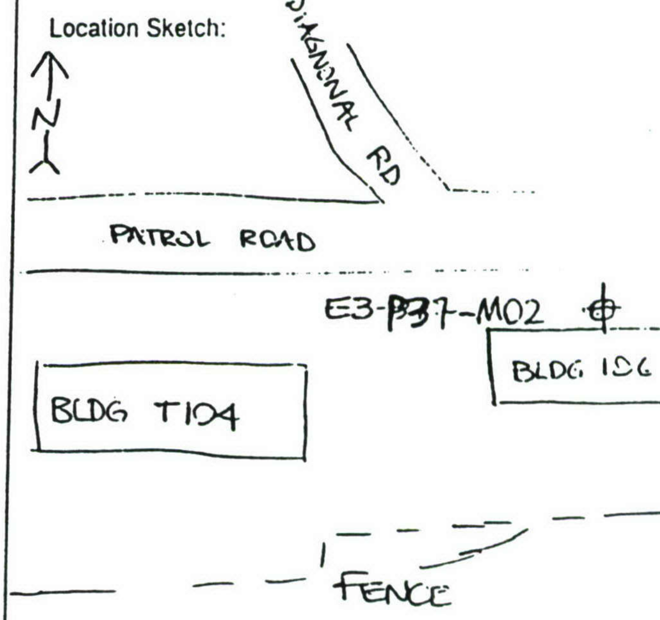
Drilling Shifts:

Date	Time		Depth of Drilling Per Shift		Date	Time		Depth of Drilling Per Shift	
	Start	End	Start	End		Start	End	Start	End
8/7/93	~~1307~~ 0917	1120	0	~~20~~ 20					

Abbreviations:

Abbr.	Meaning
SPL SP	SPLIT SPOON
R	RECOVERY

Location Sketch:



BORING LOG GENERAL DATA
Borehole Number: E3-P37-M02
Page: 1 of ____ Signature: ____
Xerox: ____
Sent to USATHAMA: ____ Date Sent: ____

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WELL CONSTRUCTION LOG

Site ID: SUDBURY ANNEX
Well Number: E3-P37 M03
Job Number:
Today's Date: 8/9/93
Well Start/Completion Dates: 8/8/93 , 8/9/93

Installation Difficulties:

Remarks:

Check as appropriate, record depths as below ground surface (BGS)

Screen:

Manufacturer: BEDROCK ENTERPRISES INC
Schedule: 40
Type: Continuous Slot HORIZONTAL 1/4" SPACING
Perforated
Louvre
Other

Materials: Stainless Steel X
PVC
Other

Length: 10'
Screened Interval: 10-20'
Diameter: (ID) 4.0" (OD) 4.5"
Thickness: .25"
Slot: Size (inches): .020" Configuration: HORIZONTAL SLOT
Open Area per Foot of Screen: 6.27 in²/ft

Casing

Manufacturer: BEDROCK ENTERPRISES, INC
Schedule: 40
Material: Stainless Steel X
PVC
Other
Length:
Diameter: (ID) 4.0" (OD) 4.5"
Thickness: .25"
Joint(s): Design THREADED
Composition PVC
Depth(s) 10.0
Centralizer: Design N/A
Composition
Depth(s)
Solvent, Glues, Cleaners: Manufacturer NONE
Use(s)
Protective Casing: Material HARDENED STEEL
Inner Diameter 6.0"

Sent to USATHAMA: Date Sent:
Page 1 of 3 Xerox: Signature:
WELL CONSTRUCTION LOG Well Number:
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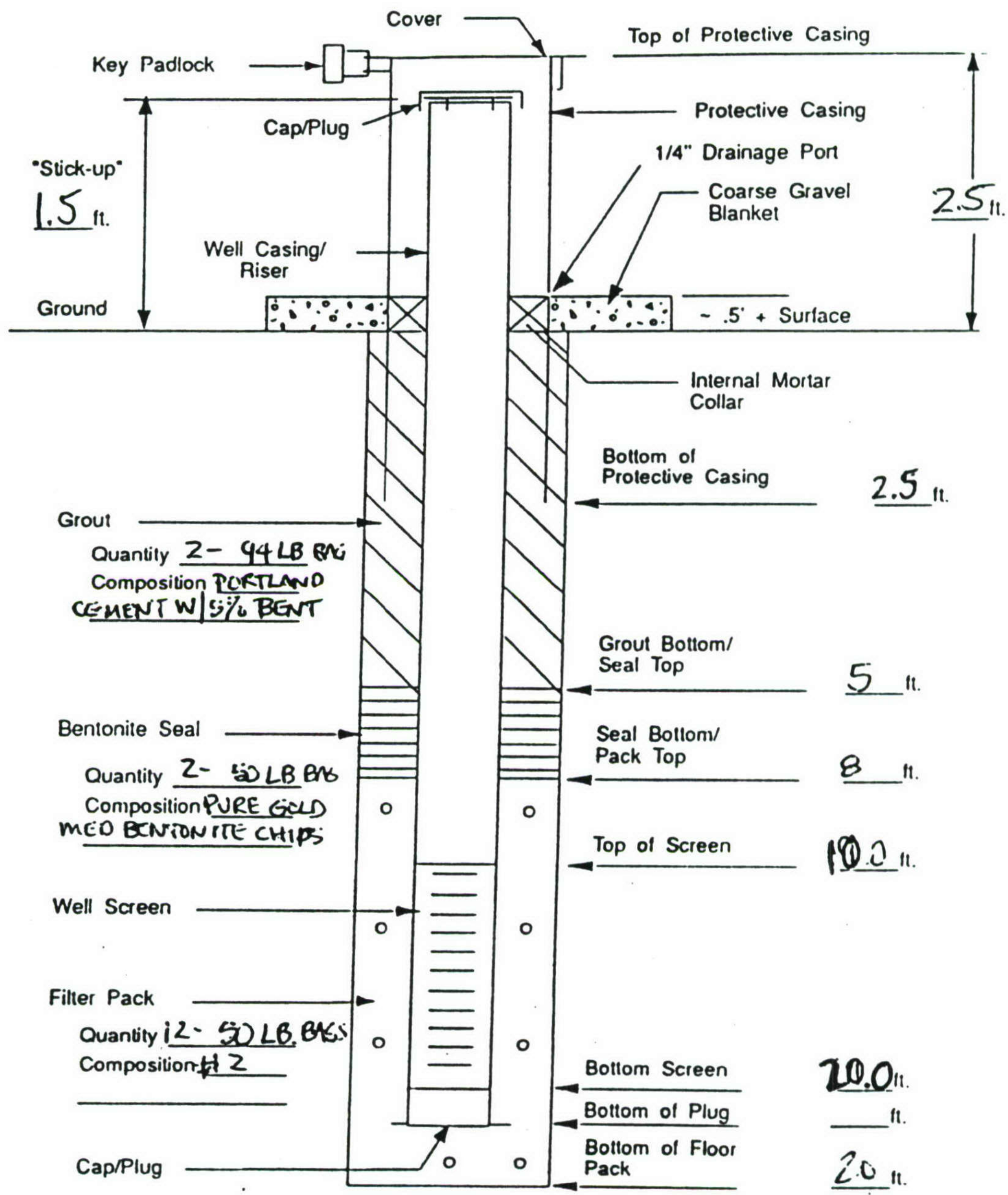
Well Construction Log:
Site ID Number: P37
Well Number: E3-P37-MO3
Today's Date: 8/9/93

WELL CONSTRUCTION



WELL CONSTRUCTION LOG
Well Number: E3-P37-MO3
Page 2 of 3 Xerox:
Signature:
Sent to USATHAMA:
Date Sent:
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Project: SUDBURY ANNEX

Boring: E3-P37-M03

Depth/ Elevation (Ft.)	USCS Symbol/ Core Sketch	Soil/Rock Description	Sample Number & Depth	Blow Count & Recovery	Drilling Data
		START/FINISH - 0917/1120 GROUND SURFACE			
		FN/MD/CS GRAINED SAND W/SUBROUNDED GRAVEL OF PHYLLITE, GRANODIORITE QTZITES. FN/MD/CS = 20/50/30 TAN, MOIST. OVA = 0.0 ppm	SS1 $\boxed{0945}$ R=1.4	3 4 5 5	NOTE: 1/SPLIT SPOONS ARE DRIVEN W/140 LB HAMMER W/30" FREEFALL 2/DEPTH & R IN FEET 3/8¼" HSAs 4/2" X 2' SPLIT SPOONS
2					
4		4.-4.4 = SAND AS ABOVE 4.4-4.6 - 100% TAN, FN GR. SAND 4.6-4.8 - FN/MD GR SAND W/MINOR SUBROUNDED GRAVEL FN/MD = 30/70. 4.8-5.1 - MD/CS GR SAND W/GRAVEL, TAN OR 5.1-5.3 FN GR SAND, NO GRAVEL 5.3-6.0 - FN/MD GR SAND W/MINOR GRAVEL SUBROUNDED PHYLLITE, GRANODIORITE QTZITE FN/MD 30/70, 10% GRAVEL	SS2 $\boxed{0952}$ R=1.7	4 5 7 9	DRILLING NOTES 1/DRILL OUT ASPHALT (0-6" ASPHALT)
6					
9		9-9.3 FN/MD SAND, FN GR SAND, FN/MED AS ABOVE W/MINOR GRAVEL 9.3-11.0 100% FN GRAINED SAND FE STREAKS MINOR SILT, LOOSE MOIST, CROSS BEDDING EVIDENT	SS3 $\boxed{1005}$ R=1.8	4 4 6 8	2/DRIVE SPLIT SP 0-2' 3/AUGER TO 4' 4/DRIVE SPLIT SPOON 4-6 5/AUGER TO 9' 6/DRIVE SPLIT SP 9-11 7/AUGER TO 14' 8/DRIVE SPLIT SP 14-16 9/H_2O @ ≈ 14.3'
11					
14	▽	H_2O @ ≈ 14.3' GREY-BROWN, WET, MD/CS GRAINED SAND W/FINES. NO GRAVEL FN/MD/CS = 30/40/30 (14-15') 15-16.0' - SILTY FN GR SAND W/FE STREAKS <10% MD GRAINS NO GRAVEL	SS4 $\boxed{1008}$ R=1.7	2 5 6 6	10/AUGER TO 19 11/DRIVE SPLIT SP 19-21' 12/TD = ~~19.0~~ ~~21.0~~ 20.0 13/REMOVE HSAs AS MW IS INSTALLED
16					
19		19-20 FN/MD/CS GR SAND W/MINOR (<10%) SUBROUNDED GRAVELS OF PHYLLITES GRANODIORITE, QTZ, QTZITE, WET BROWN. 20-20.8 FN GRAINED SAND BROWN W/HEAVY FE STAINS, BECOMING SILTIER DOWN SECTION 20.8-21 WET, GREY SILT W/ CLAY. SILT/CLAY 70/30	SS5 $\boxed{1019}$ R=1.9	5 3 5 4	SAMPLES 14-16 BX3703X1
		TD = ~~21.0~~ 20.0'			

BO G LOG GENERAL DATA Page: 2 of
Borehole Number: E3-P37-M03 Signature: [signature] X
Sent to USATHAMA: Date Sent:

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BORING LOG GENERAL DATA

Project: SUDBURY ANNEX   Boring: E3-P37-M03   Page: ~~3~~ 4 of 4

Driller & Company: MARK THIBODEAU | ESD

Geologist/Logger & Company: W. GRAF / E&E   Signature: Walter Graf

Date Boring Started: 8/9/93   Completed: 8/9/93

Water Levels (from Ground Surface)   Drilling Rig:

First Encountered: 14.3'   Date: 8/9/93

While Drilling: 14.3'   Date: 8/9/93

At Boring Completion: 14.3'   Date: 8/9/93

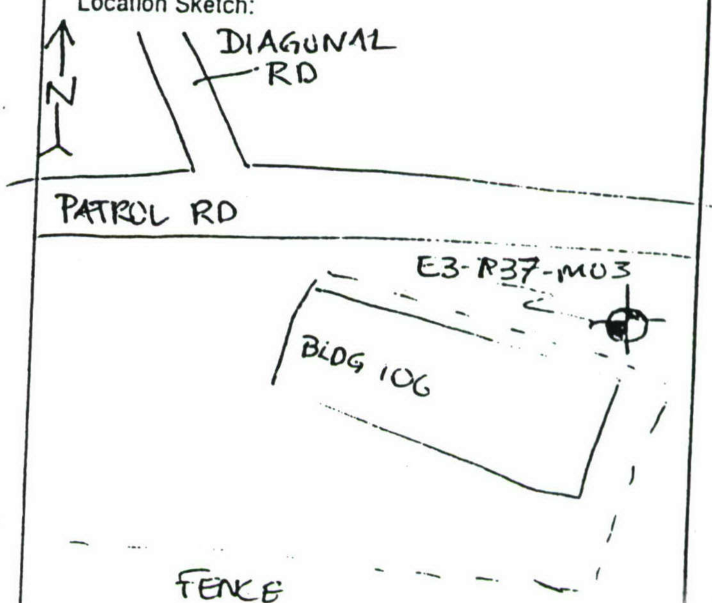
Drilling Shifts:

Date	Time		Depth of Drilling Per Shift		Date	Time		Depth of Drilling Per Shift	
	Start	End	Start	End		Start	End	Start	End
8/9/93	0917	1120	0	20					

Abbreviations:

Abbr.	Meaning
SPL' SP	SPLIT SPOON
R	RECOVERY

Location Sketch:



BORING LOG GENERAL DATA
Borehole Number: E3-P37-M03
Page: 1 of
Signature: Walter Graf
Xerox
Sent to USATHAMA: ____ Date Sent: ____

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C

APPENDIX C

WATER LEVEL MEASUREMENTS AND GROUNDWATER ELEVATION DATA

APPENDIX C

WATER LEVEL MEASUREMENTS AND GROUNDWATER ELEVATION DATA

Appendix C contains water level measurements collected from wells and staff gauges in the watersheds on 13 September and 3 December 1993 (Table C-1). In addition, surface water measurements were collected from all existing staff gauges on April 27, 1994 (Table C-2). The water level measurements were used in conjunction with survey data to calculate groundwater elevations and hydraulic gradients, and to determine general and site-specific groundwater flow at the Annex. All staff gauges were located in groundwater discharge areas. Measurements collected at these points are presumed to indicate the base levels for groundwater discharge within each watershed.

Table C-1

SUDBURY ANNEX WATER LEVEL MEASUREMENTS AND GROUNDWATER ELEVATIONS

Site Number	Monitoring Well or Staff Gauge	Ground Surface Elevation (feet AMSL)	09/13/93		12/03/93	
			Depth to Water (feet BGS)	Water Elevation (feet AMSL)	Depth to Water (feet BGS)	Water Elevation (feet AMSL)
Watershed 1B — Lower Taylor Brook						
P11	E3-P11-M01	199.97	6.32	193.65	5.20	194.77
	OHM-P11-32	201.30	7.49	193.67	6.24	195.06
	OHM-P11-33	200.40	6.73	192.90	5.46	194.94
	OHM-P11-34	204.30	11.40	193.53	10.34	193.96
	ATEC 1	NSD	NM	---	5.91*	---
	ATEC 2	NSD	NM	---	5.56*	---
	EHA3	208.00	NM	---	11.58	196.42
P13	E3-P13-M01	208.00	12.71	195.29	13.09	194.51
	E3-P13-M02	196.65	2.15	194.50	0.03	196.62
	E3-P13-M03	200.03	2.69	197.34	1.94	198.09
	E3-P13-M04	200.27	6.50	193.77	5.52	194.75
	SG-3	NSD	NA	<189.39	NA	189.39
	SG-4	NSD	NA	<185.35	NA	<185.35
	SG-9	NSD	NA	<196.50	NA	<196.50
	SG-18	NSD	NA	<197.15	NA	<197.15
Watershed 2 — Hop Brook						
P36	E3-P36-M01	210.09	14.60	195.49	14.36	195.73
	E3-P36-M02	196.86	11.77	185.09	10.27	186.59
	E3-P36-M03	191.44	14.19	177.25	13.87	177.57
	SG-19	NSD	NA	<174.90	NA	<174.90
P37	E3-P37-M01	193.90	11.54	182.36	11.92	181.98
	E3-P37-M02	191.04	14.11	176.93	14.05	176.99
	E3-P37-M03	189.45	14.30	175.15	16.21	173.24
	OHM-BW-1	190.10	16.91	173.19	17.38	172.78

Key:

* Measurement from top of inner casing.

AMSL = Above Mean Sea Level.
BGS = Below Ground Surface.
NSD = No Survey Data.
NA = Not Applicable.
NM = Not Measured.

Source: Ecology and Environment, Inc. 1994

Table C-2

ANNEX-WIDE SURFACE WATER LEVELS 4/27/94

Staff Gauge No.		Water Elevation (feet AMSL)	
SG-1		193.3	
SG-2		194.0	
SG-3		187.7	
SG-4		185.3	
SG-5	Puffer Pond	--	Gauge Removed
SG-6		196.9	
SG-7		197.6	
SG-8		193.4	
SG-9		198.9	
SG-10		199.1	
SG-11		183.0	
SG-12		183.7	
SG-13		182.2	
SG-14		Less than 182.4 (dry)	
SG-15		181.6	
SG-16		180.2	
SG-17		178.7	
SG-18		197.2	
SG-19		175.4	
SG-20		185.9	

AMSL = Above Mean Sea Level.

Source: Ecology and Environment, Inc. 1994.

D

APPENDIX D

GEOTECHNICAL DATA

APPENDIX D

GEOTECHNICAL DATA

This Appendix contains summary test results of geotechnical samples collected in each watershed at the Sudbury Annex in accordance with geotechnical specifications issued by the United States Army Toxic and Hazardous Materials Agency (USATHAMA) (now the United States Army Environmental Center (USAEC)) in 1987. Samples submitted for geotechnical analysis were collected during sediment sampling, monitoring well installation, soil boring, and surface soil sampling. A fraction of every sediment sample was submitted for geotechnical analysis. Analysis was also performed on at least one subsurface soil sample collected at each monitoring well location. Only one borehole (E3-A12-B01) sample was submitted for geotechnical analysis. The remaining geotechnical analyses were performed on surface soil samples collected in each watershed.

All geotechnical analyses were performed by Geotesting Express, in Concord, Massachusetts. Summary tables of results were adapted from computer files provided by Geotesting Express. A separate table is provided for samples collected within each watershed. Detailed laboratory reports presented to Ecology and Environment, Inc. (E & E) by Geotesting Express on 8, 18, and 29 November are on file with the E & E project manager (Geotesting Express Report Nos. 1, 2, and 3).

Geotechnical tests performed include grain size (ASTM D422) and Atterberg Limits analyses (ASTM D4318). Additionally, samples were assigned a Unified Soil Classification System (USCS) classification. It was not possible to perform Atterberg Limits analysis on all samples due to the non-plastic nature of the sample material. Samples were identified as non-plastic either by visual inspection or by a partial Atterberg Limits analyses.

The following system was followed in identifying geotechnical samples:

Character	=	1	2		3	4	5		6	7	8
Site ID	=	E	3	-	P	3	7	-	S	0	3

Character 1 = Contractor Identifier
E=Ecology & Environment, Inc.

Character 2 = Year of the Field Activity
3 = 1993

Hyphen

Character 3-5 = Site Identifier
P37 = Site P37

Hyphen

Character 6 = Sample Type
S = surface soil
M = monitoring well
D = sediment
B = borehole

Character 7-8 = Sample Number
Consecutive numbers for samples collected at each site.

WATERSHED 1B — LOWER TAYLOR BROOK	
P11	Building T405 Area
P13	Massachusetts Fire Fighting Academy

Table D-1

SUMMARY OF GEOTECHNICAL TEST RESULTS
SUDBURY TRAINING ANNEX - WATERSHED 1B

Sample Depth[a] (feet)	Sample ID	Site ID	Moisture Content, Percent Dry Weight	Classification	Percent Passing #4 Seive	Percent Passing #200 Seive	Liquid Limit (LL) (%)	Plastic Limit, (PL) (%)	Plasticity Index, PI
6-8'	BX1101X1	E3-P11-M01	24.0	CL-ML	98	88	24.3	18.7	5.6
9-11'	BX1101X1	E3-P11-M01	23.6	ML	100	66	non-plastic	non-plastic	non-plastic
--	DX1101X1	E3-P11-D01	48.9	SM	96	30	76.5	54.3	22.3
--	DX1102X1	E3-P11-D02	141.2	SM	100	50	156.9	118.6	38.4
--	DXP11031	E3-P11-D03	21.5	SP	87	1	non-plastic	non-plastic	non-plastic
14-16'	BX1301X1	E3-P13-M01	28.1	SP-SM	100	9	non-plastic	non-plastic	non-plastic
19-21'	BX1301X1	E3-P13-M01	23.6	SP-SM	100	9	non-plastic	non-plastic	non-plastic
4-6'	BX1302X1	E3-P13-M02	16.3	SP	84	4	non-plastic	non-plastic	non-plastic
14-16'	BX1302X1	E3-P13-M02	23.7	SP-SM	99	7	non-plastic	non-plastic	non-plastic
4-6'	BX1303X1	E3-P13-M03	16.4	SP	99	4	non-plastic	non-plastic	non-plastic
14-16'	BX1303X1	E3-P13-M03	28.9	ML	100	56	non-plastic	non-plastic	non-plastic
9-11'	BX1304X1	E3-P13-M04	20.0	ML	97	53	20.9	19.4	1.5
--	DX1301X1	E3-P13-D01	1595.9	OH	100	85	423.5	301.4	122.1
--	DX1302X1	E3-P13-D02	3.8	SP	96	4	non-plastic	non-plastic	non-plastic
--	DX1303X1	E3-P13-D03	35.2	SW-SM	97	10	non-plastic	non-plastic	non-plastic
--	DX1304X1	E3-P13-D04	72.2	SP-SM	94	6	non-plastic	non-plastic	non-plastic
--	DX1305X1	E3-P13-D05	40.4	SP-SM	100	9	non-plastic	non-plastic	non-plastic

11:UC6101/RC1287_V4-10/19/94-D1

Table D-1 (continued)

Key:

[a] Only provided for subsurface samples.

CL = Clay.
ML = Silt.
OH = Organic.
SM = Silty sand.
SP = Sand, poorly sorted.
SW = Sand, well sorted.

Source: Ecology and Environment, Inc. 1994.

WATERSHED 2 — HOP BROOK	
A12	PCB Spill; Remediation Area
P36	Former Raytheon Building T104
P37	Building T106 UST

Table D-2

SUMMARY OF GEOTECHNICAL TEST RESULTS
SUDBURY TRAINING ANNEX - WATERSHED 2

Sample Depth[a] (feet)	Sample ID	Site ID	Moisture Content, Percent Dry Weight	Classification	Percent Passing #4 Seive	Percent Passing #200 Seive	Liquid Limit, (PL) (%)	Plastic Limit, (PL) (%)	Plasticity Index, PI
--	BX120101	E3-A12-B01	6.9	SM	96	16	non-plastic	non-plastic	non-plastic
9-11'	BX3601X1	E3-P36-M01	10.0	SM	94	34	13.9	12.5	1.5
9-11'	BX3602X1	E3-P36-M02	11.8	SM	97	34	non-plastic	non-plastic	non-plastic
14-16'	BX3603X1	E3-P36-M03	9.2	SM	81	19	non-plastic	non-plastic	non-plastic
--	SX3601X1	E3-P36-S01	1.1	SW-SM	91	10	non-plastic	non-plastic	non-plastic
14-16'	BX3701X1	E3-P37-M01	10.1	SM	90	25	non-plastic	non-plastic	non-plastic
14-16'	BX3702X1	E3-P37-M02	20.9	ML	99	59	non-plastic	non-plastic	non-plastic
14-16'	BX3703X1	E3-P37-M03	20.7	SP-SM	100	11	non-plastic	non-plastic	non-plastic
--	SX3703X1	E3-P37-S03	6.6	SM	98	12	non-plastic	non-plastic	non-plastic
--	DXP37011	E3-P37-D01	250.2	SM	99	14	non-plastic	non-plastic	non-plastic
--	DXP37021	E3-P37-D02	23.2	SP	62	1	non-plastic	non-plastic	non-plastic
--	DXP37031	E3-P37-D03	770.4	SM	92	38	non-plastic	non-plastic	non-plastic

Key:

[a] Only provided for subsurface samples.

ML = Silt.
SM = Silty sand.
SP = Sand, poorly sorted.
SW = Sand, well sorted.

Source: Ecology and Environment, Inc. 1994.

11:UC6101/RC1287_V4-10/19/94-D1

E

APPENDIX E

GEOPHYSICAL SURVEYS

TABLE OF CONTENTS

LIST OF FIGURES

APPENDIX E

GEOPHYSICAL SURVEYS

E.1 INTRODUCTION

This Appendix E contains reports describing the methods and results of the geophysical surveys conducted at the Sudbury Training Annex (the Annex) in Middlesex County, Massachusetts. This work was performed by E & E as part of an investigation for the United States Army Environmental Center (USAEC) from April to November of 1993. Survey methods, targets, and goals varied according to the specific needs of each site. Exploration targets included mapping of subsurface geology (bedrock and groundwater table), buried metallic objects, pipelines or leach fields, and suspected dump sites containing metallic and non-metallic wastes.

Geophysical work was performed at both Remedial Investigation (RI) sites. However, during E & E's investigations, adjacent sites were combined into a single geophysical survey because exploration targets were common to the combined sites. The following geophysical methods were used at the Annex:

- **Seismic Refraction (SR):** Conducted surveys at P11/P13 and P36/P37.
- **Electromagnetic Conductivity (EM):** Conducted surveys at P13 and P36/P37.
- **Magnetometry (MAG):** Conducted a survey at P13.
- **Ground Penetrating Radar (GPR):** Conducted a survey at A12.

The SR survey was performed 20 to 26 May 1993, and all EM, MAG, and GPR work was performed 2 to 13 August 1993.

The survey team searched the draft OHM report to gather information and existing data on previous geophysical surveys at relevant sites. In many cases, this background search eliminated redundant data collection. The results of this background data search are discussed with the results from site surveys in Section 3 of this appendix.

E.2 METHODOLOGIES

The selection of the geophysical method to be used at a specific site is a result of the exploration target and the anticipated response of an instrument to that target. Often, multiple methods are chosen when combined data can enhance the definition of an exploration target.

All geophysical survey methods comprise three phases: data acquisition, data reduction, and interpretation. For example, operation of a metal detector can be considered as using all three phases though the phases occur almost simultaneously in the operator's mind. Data acquisition and data reduction methods for the different instruments used in this geophysical survey will be discussed in the following subsections. Interpretation methods will be discussed in both this section and Section 3 of this appendix to facilitate description of the geophysical survey. Appropriate field or processed data from the different geophysical methods used at each site are included as attachments following Section 3.

E.2.1 Seismic Refraction Surveys

The seismic method for subsurface exploration works by measuring seismic or sound waves as they are reflected off materials of different densities. The physics of wave propagation provides a standard by which material density can be determined.

The components for acquiring seismic data are:

1. SHOT — This is the energy source that generates seismic, or acoustic waves, to propagate through the subsurface.

2. RECEIVER — This instrument converts ground motion caused by the seismic waves into an electrical signal.

3. RECORDER — This electrical instrument converts and stores the signals from the receiver into positive or negative integers of varying amplitudes that correlate with the ground motion intensity and direction (up or down) at that receiver. After the shot is generated, the recorder continuously samples each receiver at a discrete time interval until a user specified total time is reached.

The interpretation of seismic data involves the reduction of differential travel times to an event, to determine the velocities of the material through which the energy is traveling. Using true velocities (in feet or meters per second) and the time delay (in milliseconds), depth can be calculated. The depths calculated can then be subtracted from the shot site elevations, plotted on a base map, and the horizon of interest contoured.

An ABEM MINILOC seismograph was used to collect the seismic data. Three, 36-trace records were generated in a somewhat unique way for each seismic line as follows: Three geophones were "planted" on the seismic line — one at each end with the third in the middle. Then, 36 shot points were spaced evenly between the two end geophones, with each shot recorded as a single trace in each of the three geophone records. Shot energy was

created by using a 12-pound sledge hammer to strike a rubberized-plastic plate. Three to five shots were "stacked" at each shotpoint location. After all shots were made, the geophysicists examined the resultant data and stored satisfactory data on a laptop computer.

Field interpretation was done on select lines of data. The last data line of the day and the first data line of a new area were usually selected. The geophysicists verified acquisition parameters by using the MINILOC's built-in software.

They then performed final interpretation using SeisREFA, a software package from OYO Corporation. The following procedures were implemented to process the data from raw records to final contour maps. To reduce ambiguity, steps 2-5 were often performed several times.

DATA REDUCTION PROCEDURES

1. Convert the MINILOC raw data to a format compatible with SeisREFA by entering the data into the computer.

2. Pick the seismic first breaks interactively on the computer.

3. Determine the number of layers, and their velocities, from the first breaks, time-distance graph.

4. Generate an initial geologic model, using the layers and velocities given, by applying SeisREFA.

5. Interactively edit the model to get a best fit of model response to the time-distance graph.

6. Convert model layer depths from meters to feet.

7. Plot layer depths from all seismic lines onto a base map and contour.

The contour maps created during this survey are displayed and discussed in Section 3 of this report. Section 3 also has a data packet for each site surveyed including:

- Raw records showing the three seismic records for each line.

- Model Profiles. Lower portions show final models with layer velocities (in kilometers per second) and seismic raypaths. Upper portions show the first-break, time-distance graph (circles connected by solid lines), with the model response superimposed (dotted lines).

E.2.2 Electromagnetic Conductivity Surveys

The instrument used for this geophysical method was the Geonics EM31 Terrain Conductivity Meter. This meter continuously measures the apparent terrain conductivity of materials beneath and immediately surrounding it. The EM31 consists of a small control box with two opposing booms extending approximately 5-1/2 feet from the box. At the end of one boom is a transmitter coil, with a receiver coil at the end of the other boom. The coils are fixed in parallel planes with the EM31 booms perpendicular to each plane. The depth of investigation achieved by the EM31 at the Annex sites was approximately 18 feet for the vertical dipole and 9 feet for the horizontal dipole. The different dipoles are applied by rotating the EM31 90 degrees about the axis through the booms.

Two general conditions can occur in the subsurface that affect the type of data observed from the EM31. Where subsurface conditions are horizontally homogenous, all readings, as the operator turns to orient the boom in different directions, should be equal, or isotropic. However, where non-homogenous conditions occur, non-isotropic readings will be observed. For example, if an operator is directly over a buried pipe, with the instrument booms perpendicular to this pipe, then a reading less than zero (<0) may be observed. This is due to the highly conductive pipe short-circuiting the induced subsurface current between transmitter and receiver. If the operator turns 90 degrees making the booms parallel with the pipe, the readings should then be much higher than those of the background terrain.

Two basic EM survey methods were used at the Annex; a gridded survey and a reconnaissance survey. During a gridded survey, data is collected and recorded at stations that have been established by some form of land survey method. Site P13 was the only site where an EM gridded survey was performed. Data reduction and analysis are presented in Volume II of the RI (Section 2.2).

An EM reconnaissance survey can be considered as one that acquires data for real-time analysis, because the operator continuously watches the EM31 meter for any readings that deviate from background levels. In this type of survey the results are usually recorded but not the data. For example, a pipeline may be located by walking back and forth with an EM31 over a few locations and flagging the pipeline at each location. This type of survey is usually not conducive to locating more subtle anomalies, but is very cost effective when the exploration targets are large or shallow, highly conductive objects such as USTs or pipes.

All conductivity readings from the EM31 are in millimhos per meter (mmhos/m).

E.2.3 Magnetrometry Surveys

Operators also used an EG&G G856 proton precession magnetometer during the Annex survey. This instrument provides readings that are a measurement of the total Earth's magnetic field, expressed in gammas. The presence of ferrous metals will cause anomalous readings from the local background reading, allowing operators to identify and map the presence of metal objects.

The first step in a MAG survey is to establish stations (usually on a grid) where readings will be taken. A base station is established at a background location and an initial reading taken. Station readings are then taken and recorded, along with the station location, with a final base station reading taken at the end of the day, or at survey completion. The operator periodically returns to the base station to record a new reading and the time it was taken. These base station readings are used to check against an ongoing magnetic storm or are used to correct the survey data for diurnal variations. Any observable metal in the survey area should be logged and located so any correlation with magnetic anomalies can be determined later.

Data reduction begins with correction for diurnal variations. The base station readings are adjusted to a baseline value and these adjustments are interpolated and applied to the intervening data readings. There are times when this step may be skipped because the exploration target yields anomalies much greater than the diurnal variations. This data (corrected, or uncorrected) is then posted on a base map and contoured.

There are two types of anomalies that may be seen on a magnetic data contour map - a dipole anomaly or a monopole anomaly. Most ferrous metal objects in the northern hemisphere exhibit a dipole anomaly where the southern portion of the object would cause readings greater than background (positive pole), with the negative pole expressed at the northern end. Where the vertical axis of an object is much greater than the horizontal, a monopole anomaly occurs. This is due to the negative pole being masked by the positive pole, which is above it and closer to the instrument.

E.2.4 Ground Penetrating Radar

Survey operators used a GSSI Model SIR-3 GPR unit with 500 Mega Hertz (Mhz) and 900 Mhz antennas available to complete investigations at the Annex.

The GPR method involves transmission of an energy pulse into the subsurface by the unit's antenna. The pulse is then partially reflected back to the antenna's receiver after interfacing with materials having differing electrical properties. The velocity of a pulse through a material is the distance it travels in that material divided by the time needed to travel that distance. This is analogous to the seismic method in that the instrument records the time delays between the energy transmission and when reflections of that energy arrive at the receiver. The SIR-3 processes this data through gains and filters and displays it on a graphical recorder.

Figure 2-1 shows a GPR record shot over a known pipeline that crosses the Annex. This was done to calibrate instrument settings for the region and use the pipe depth for correlation to a site's data. As the GPR antenna approaches a spherical surface, such as a pipeline running perpendicular to the direction of antenna travel, reflections from that surface return along a path at an acute angle to the vertical. This angle, and the time required for reflections traveling along that path, decrease until the antenna is directly over the reflecting surface. The delay time and angle then increase again as the antenna proceeds along the survey line. Since reflections are plotted on the graphic recorder directly below the current antenna location, a parabolic feature is observed.

The pipeline in Figure 2-1 is located within the top of the parabolic reflector. A known depth to this pipeline could not be obtained from the pipeline owner, although a company representative said 2 to 4 feet was the normal pipeline depth. A procedure was used that evaluates the geometry of the parabola to yield qualitative values for its depth and the velocity of the overlying materials. Using this method, an approximate depth to this pipe of 6.3 feet and an approximate average velocity of 2.0 nanoseconds/foot for the overlying materials were calculated. This velocity appears a little too fast for most near-surface materials found at the Annex. By using a velocity between 2.5 and 3.0 nanoseconds/foot, depending on the surface material at a GPR line, reliable estimates within one to two feet should be realized. (Note: A quantitative approach requires the determination of more exact subsurface velocities, with significantly greater data acquisition and processing times.)

To collect GPR data, operators first selected a line location and staked line endpoints. The ground surface was then cleared to allow for the smooth travel of the antenna along the line. Fiberglass tape was laid out along the line with zero marked at one end. The antenna was then placed just beyond the beginning of the line and connected to the nearby GPR recorder. The recorder was turned on and the antenna was slowly pulled along the line at a nearly constant speed. As the center of the antenna passed the tape zero, and at specified intervals, a button was pushed that caused a location marker to be plotted on the graphic display.

Data reduction and interpretation can vary depending on the exploration target. The procedures used for specific sites will be discussed in the results section (Section 3).

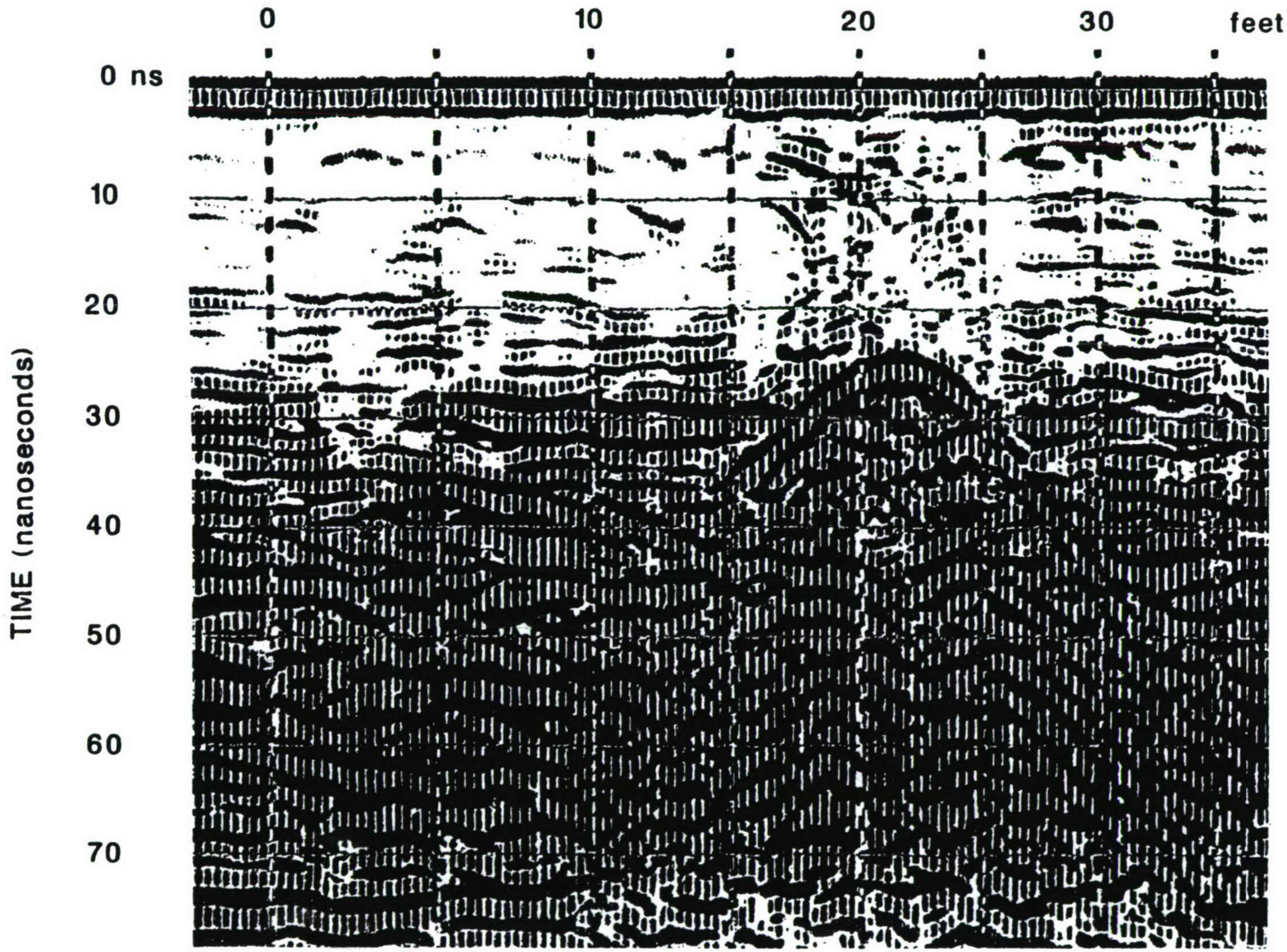

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Figure 2-1: GPR TEST PROFILE OVER KNOWN PIPELINE

E.3 GEOPHYSICAL SURVEY RESULTS

The results for geophysical work at the Annex are grouped below by watershed and site. Geophysical data discussed and referenced in this section can be found in the attachments following this section, grouped by sites in the order in which they were addressed. In Figures, some of the sites may be referred to as Study Areas. For this Appendix, the terms will be used interchangeably.

E.3.1 Site P11/P13

Seismic Survey

The E & E team shot eight seismic lines at Site P11/P13 for a total of 2,658 linear feet. Data quality was good to excellent for most data. Three-layer models were used in the data reduction, with velocities throughout the sites fairly constant. The upper layer of the model represents the unsaturated overburden, with velocities averaging 1,190 feet per second. The model's middle layer detailed saturated overburden and averaged about 5,100 feet per second, and the model's deepest layer, or bedrock, averaged about 14,000 feet per second.

Figure 3-1 shows bedrock contours, as derived from seismic depth calculations. Figure 3-2 shows the contours for the top of the middle layer (approximate water table). It is important to note that these contour elevations are accurate in a relative rather than an absolute sense. This is because a single velocity was used for a layer across the whole seismic line because of a limitation in the data reduction procedure and software. Often, minor lateral changes in geology also mean minor velocity changes, which can cause slightly inaccurate depth determinations of up to 1 or 2 feet in Figure 3-1. These inaccuracies would not result in any major change in the overall bedrock surface. However, in Figure 3-2, the groundwater contours are more susceptible to these minor variations. Nevertheless, the relative highs and lows are the most significant information, and their locations would not be affected.

The bedrock contours in Figure 3-1 indicate a somewhat undulating surface in the western portion of the survey. A bedrock high appears to run along the southeasterly edge of the site, with a trough, or basinal feature, extending from the center of the site to the north. A groundwater high (Figure 3–2) is located over this trough, or bedrock low. Drainage from this high appears to be to the north, northwest, and the west-southwest. Some drainage probably also occurs to the southeast, although that is not evident in the groundwater contours. Seismic line SSL–8 indicates that the water table comes up at the drainage canal just south of the site implying that this is a losing stream.

The seismic data can be found in Attachment A, following this report. For each line, this consists of the three seismic records and the time-distance graph with the model profile.

EM/MAG Survey

Operators performed a gridded EM conductivity and magnetometer survey at Site P13 with data collected on 20-foot spacings and an EM reconnaissance survey around Buildings

T406, T407, and T462. Figure 3-3 shows the site with grid node locations and the inferred septic system and leach field indicated by the dashed lines. The location of the system was deduced from the geophysical data as well as from an old drawing of the Site P13 sewer system, although pipe locations from Building T406 are slightly different from those indicated on the drawing. EM data was collected by taking readings with the boom first oriented along the grid north-south and then in the east-west direction. Operators took vertical and horizontal dipole readings for a total of four readings at each grid node. A single total magnetic field reading was also taken at each node. The EM data was analyzed by calculating the difference between the N-S and E-W readings. The shaded areas of Figures 3-4 and 3-5 outline where this difference was greater than 0.1 mmhos/m, and the arrows at the enclosed grid nodes indicate non-isotropic readings, with the direction of the arrow indicating the highest reading. By blocking off and shading the areas of non-isotropic readings, it was hoped that a pattern would emerge locating the leach field pipes.

Contours of isotropic data were not generated due to EM31 background readings before and after lunch differing by about 3.0 mmhos/m. The probable cause may have been activities at the USAF radar station approximately 2,000 feet west-southwest of the site. A qualitative analysis of the isotropic readings showed no anomalies in homogenous terrain conductivity. Non-isotropic readings evaluation, and the magnetometry survey, were not affected by this interference.

The magnetometer data was reduced by applying diurnal corrections to it, plotting the corrected readings, then contouring the data (Figure 3-6). Diurnal corrections were determined from base station readings taken about every half-hour.

Figure 3-3 also shows anomalies identified. Location "A" is a possible manhole, or cleanout to the septic system, located at grid coordinates N 2+75, E 1+69. This location was observed in the field as a slight depression, as if it had been opened up and surface soil had washed into it. An EM reconnaissance directly over this location yielded locally anomalous readings. Location "B" is a well defined magnetic anomaly (Figure 3-6) of moderate strength. Location "C" appears to be a good area to look for the leach field pipes, as determined from the EM data. A trench-like pit perpendicular to the pipe length would be the best exploration method. Location "D" was chosen from the magnetic data, along with the results from the EM reconnaissance survey around Building T406. A test pit from the corner of the building addition towards grid coordinates N2+80, e1.00 might be the best approach.

The EM and MAG data can be found in Attachment B following this report.

E.3.3 Site P36/P37

Seismic Survey

Nine seismic lines were shot at Site P36/P37, for a total of 2,838 linear feet. Data quality was fair to good for most of the data, although the pine needle fluff in forested areas had to be removed at geophone and shot locations to ensure good contact with the ground. Three-layer models were used in the data reduction for most lines, with velocities throughout the site fairly constant. The model's upper layer represented the unsaturated overburden, with velocities averaging 1,200 feet per second. The model's middle layer detailed saturated overburden averaging about 5,100 feet per second. The model's deepest layer, or bedrock, averaged about 13,200 feet per second. Seismic line SSL-14 did not exhibit the same data quality, layer distinctiveness, or velocities as the rest of the survey. The seismic records were of very poor quality, and all attempts to produce a model profile that correlated with the time-distance graph were unsatisfactory. Therefore, the data from this line was not used to generate the contour maps in the final interpretation.

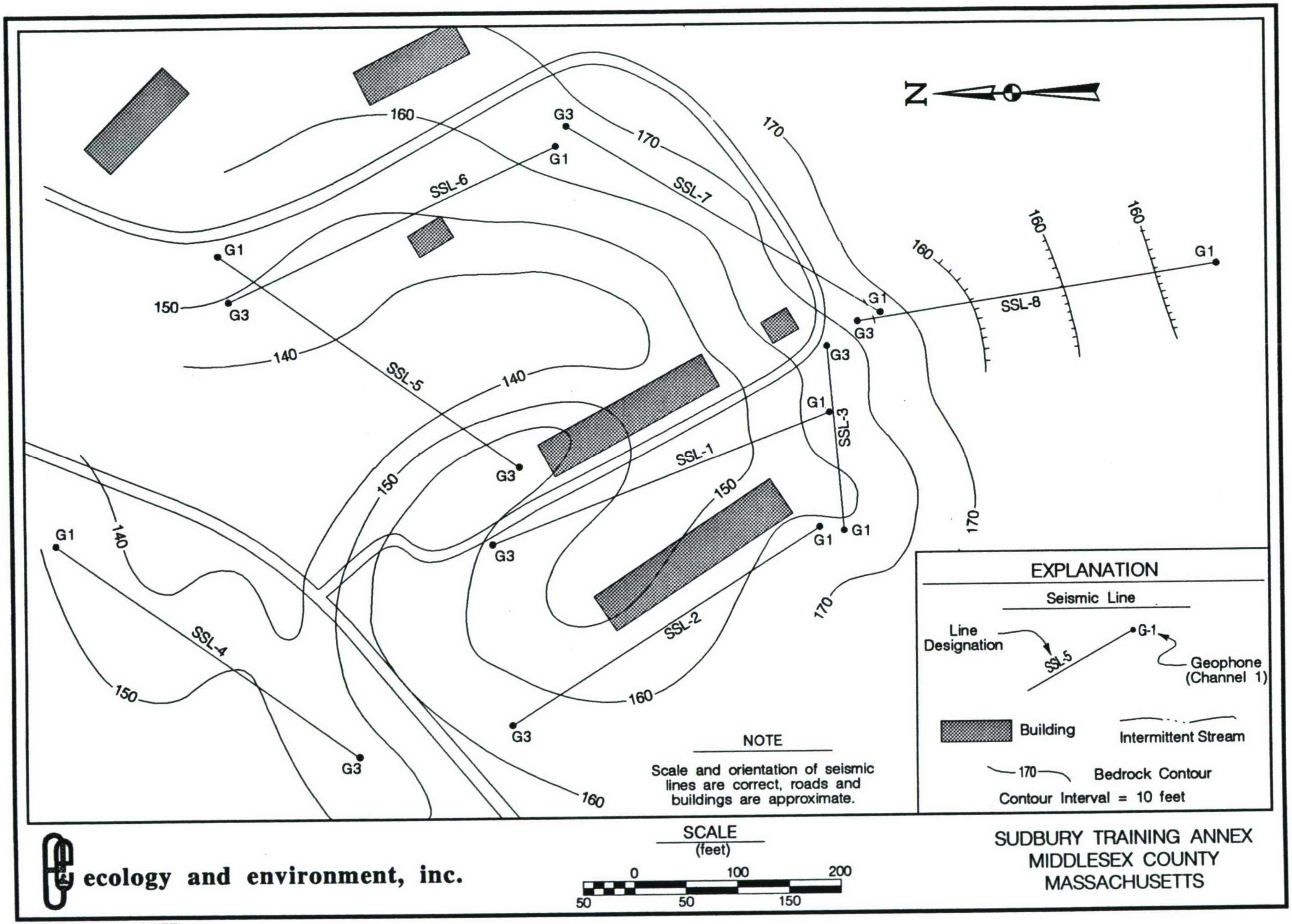
Figure 3-7 shows the bedrock contours as derived from seismic depth calculations. Figure 3-8 shows the contours for the top of the middle layer (approximate water table). It is important to note that these contour elevations are accurate in a relative rather than an absolute sense because a single velocity was used for a layer across the whole seismic line, because of a limitation in the data reduction procedure and software. Often, minor lateral changes in geology also mean minor velocity changes, which can cause slightly inaccurate depth determinations, as much as 1 to 2 feet. Because both maps were drawn with 10-foot contour intervals, these inaccuracies would result in little difference in the overall spatial attitude of the contours.

In general, the bedrock contours shown in Figure 3-7 indicate that this surface is sub-parallel with the ground surface. That is, the bedrock highs are found beneath topographic highs, and dip towards the valleys. However, one exception exists in the northwest portion of the site where the bedrock deepens to the northwest while the topography remains fairly flat. The apparent groundwater contours shown on Figure 3-8 also exhibit this sub-parallel attitude, although in the northwestern portion of the survey the water table also appears to remain fairly flat following the topography.

This seismic data can be found at the end of Attachment C, following this report. Three seismic records and a time-distance graph with model profile detail each seismic line.

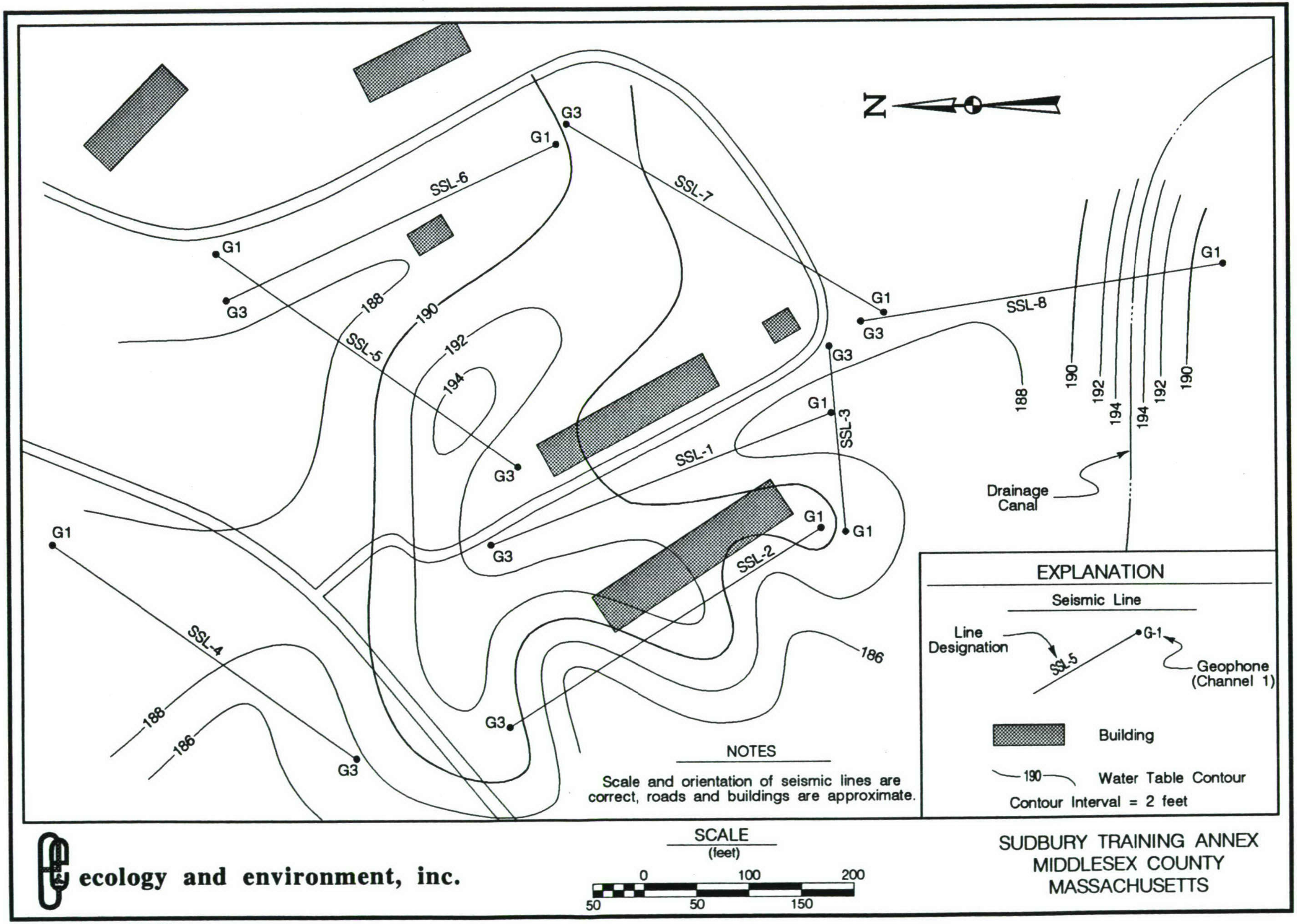
EM Reconnaissance Survey

An EM reconnaissance survey was performed around and between the buildings at Site P36/P37 and found large amounts of metal on the ground near the buildings. This debris, and the two metal buildings caused a great deal of interference that masked anomalous readings from subsurface objects. Using the EM31, the reconnaissance survey team found an apparent buried pipe running between the two buildings. This inferred pipe appeared to be laid behind Building T104 where it extended above ground towards a concrete pad containing a vertical pipe. This pad was located about 40 feet south of the center of Building T106.



Prepared By: L.J.BAER

Figure 3-1: P11/P13 STUDY AREA - GENERALIZED BEDROCK CONTOUR MAP



Prepared By: L.J.BAER

Figure 3-2: P11/P13 STUDY AREA - GENERALIZED GROUNDWATER CONTOUR MAP

sud11wtr.cdr

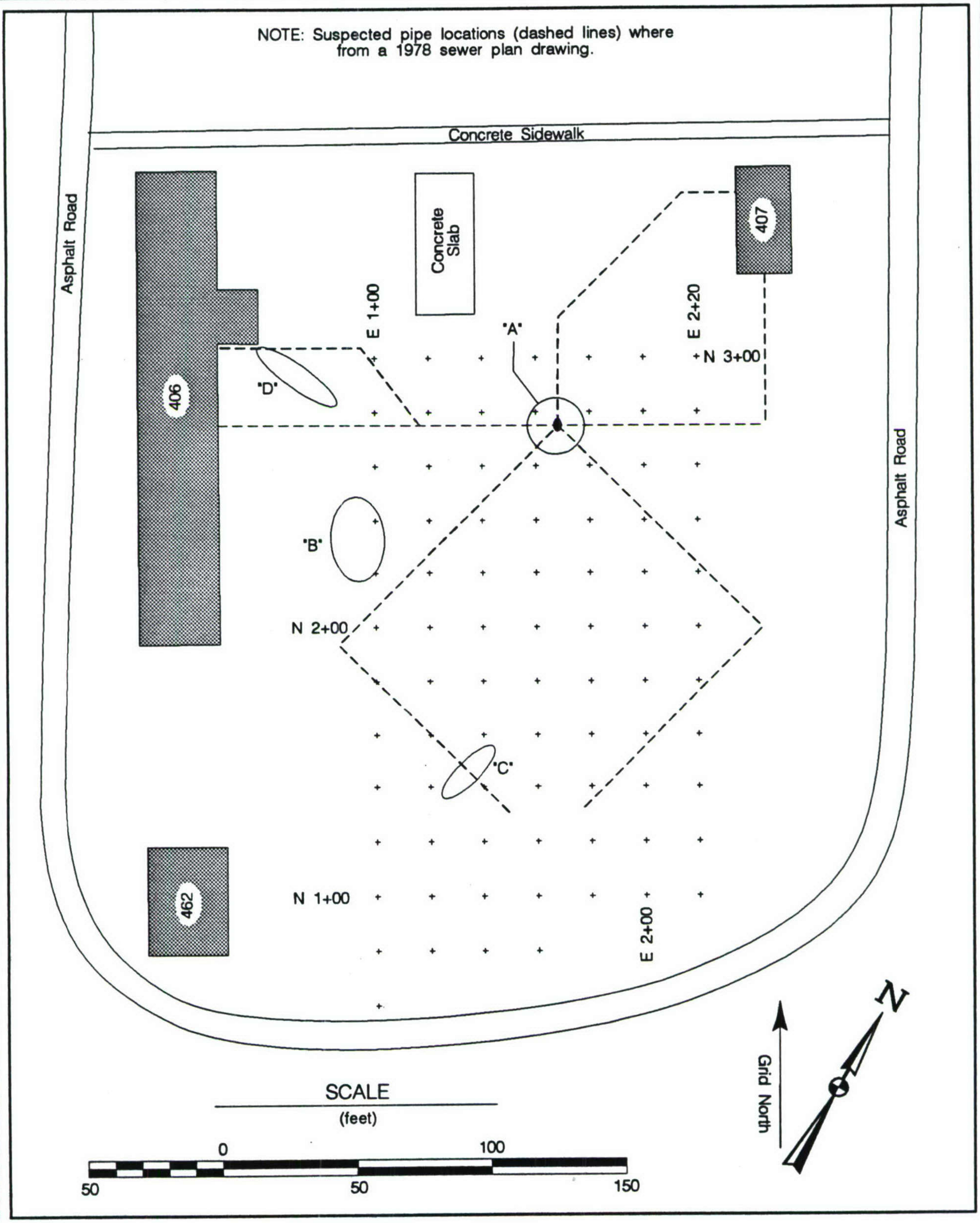


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Figure 3-3: P13 STUDY AREA - GEOPHYSICAL GRID LOCATION MAP

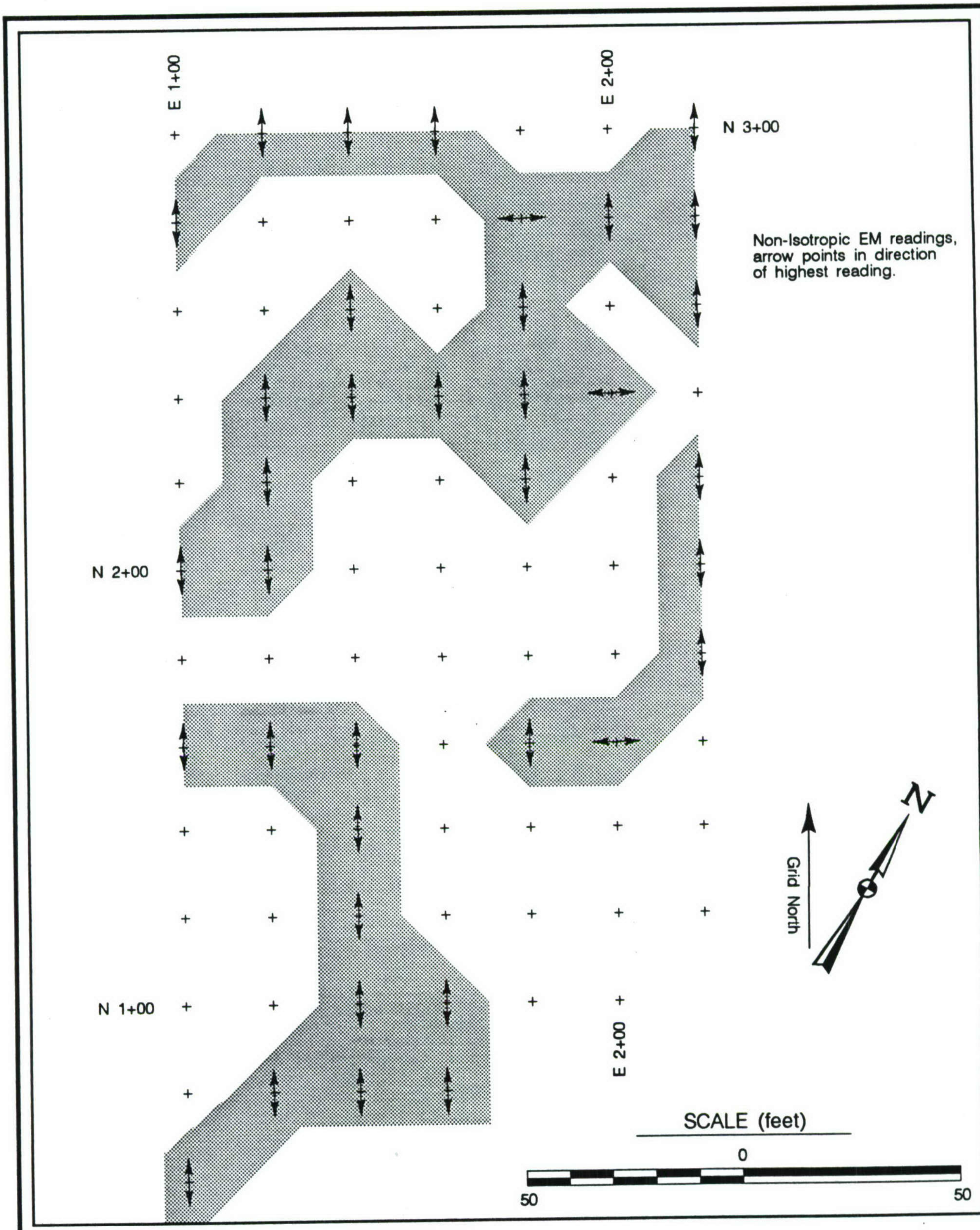

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Figure 3-4: P13 STUDY AREA - EM31 VERTICAL DIPOLE

p13-emvt.cdr

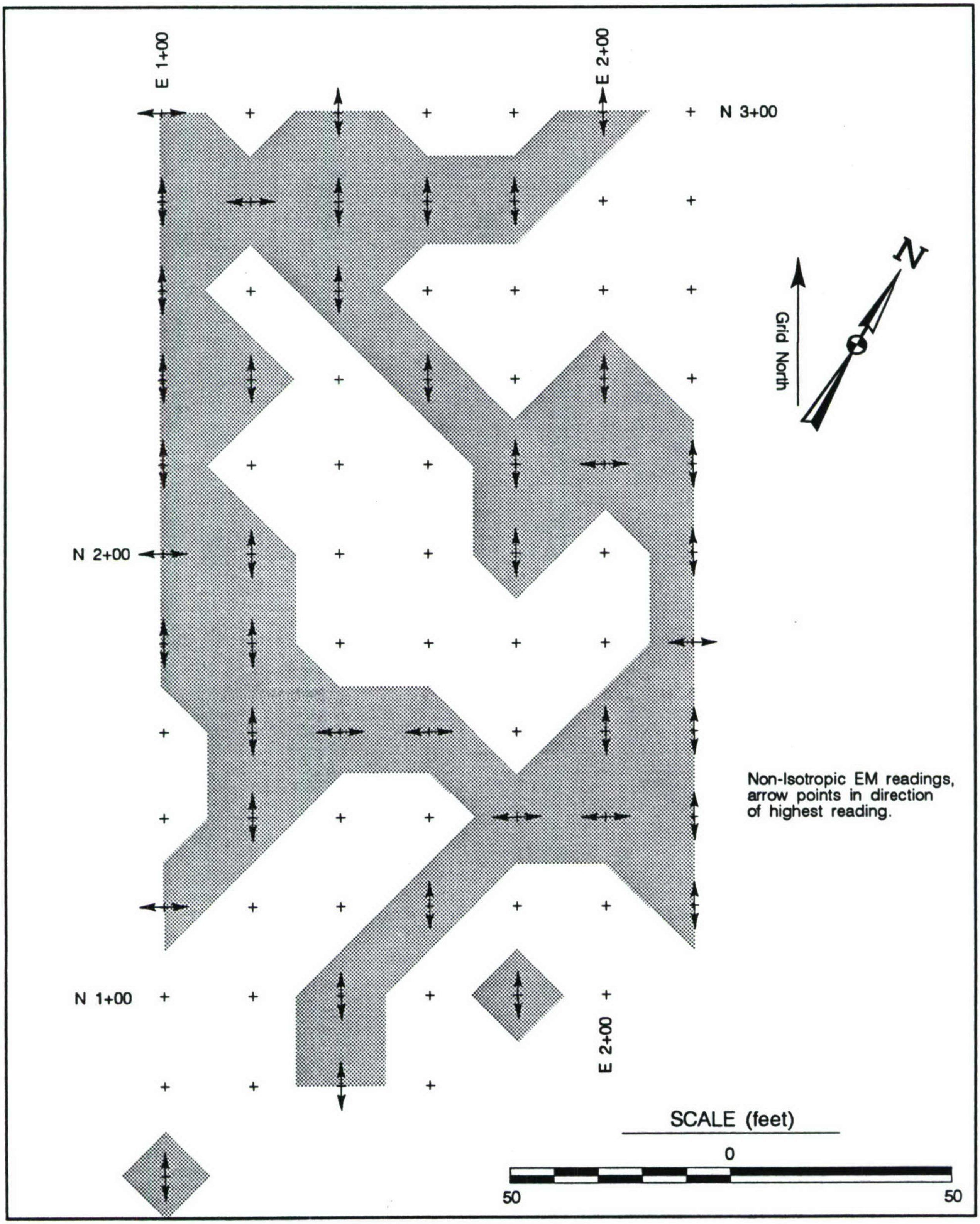

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Figure 3-5: P13 STUDY AREA - EM31 HORIZONTAL DIPOLE

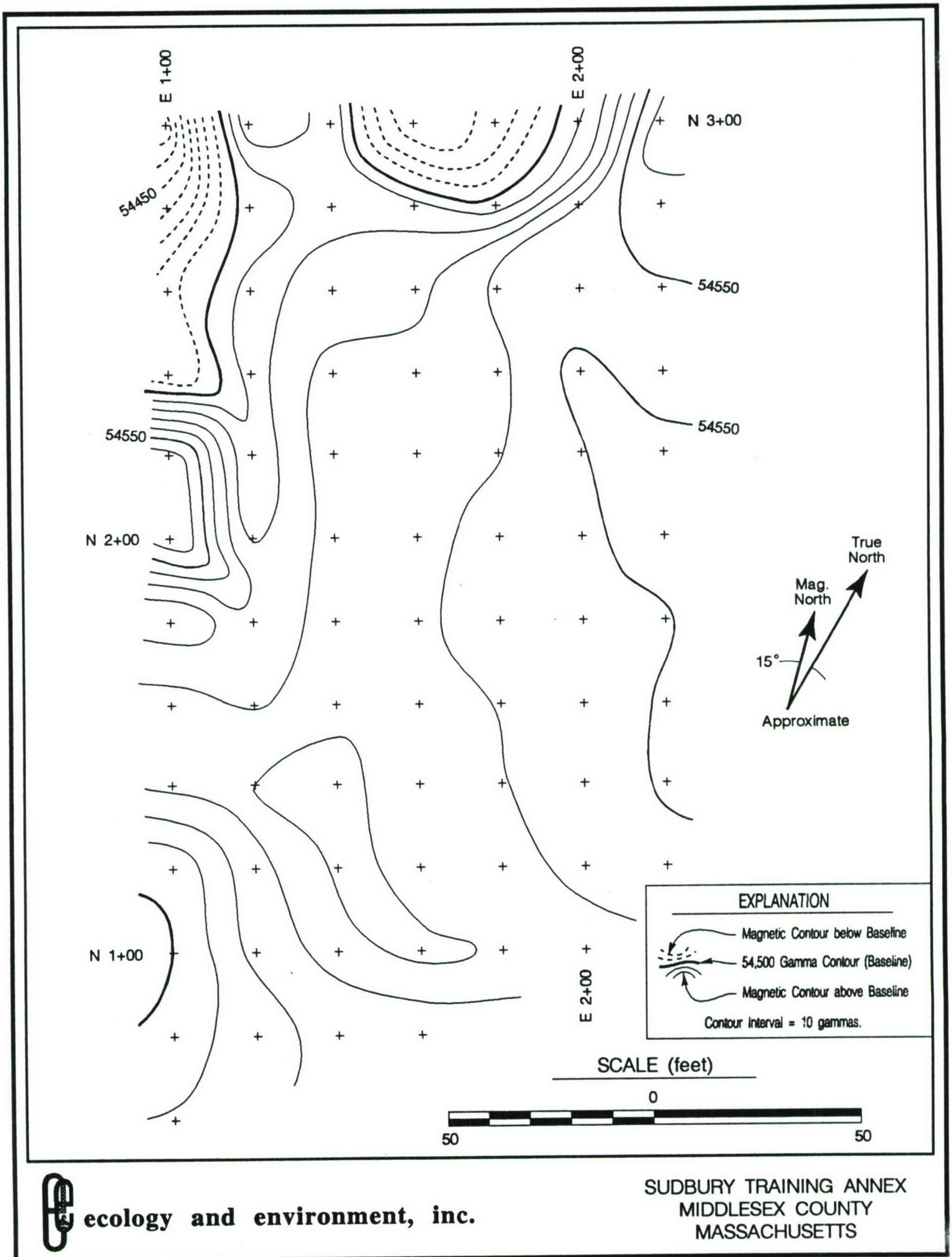

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Figure 3-6: P13 STUDY AREA - TOTAL MAGNETIC FIELD CONTOUR MAP

p13-mag.cdr

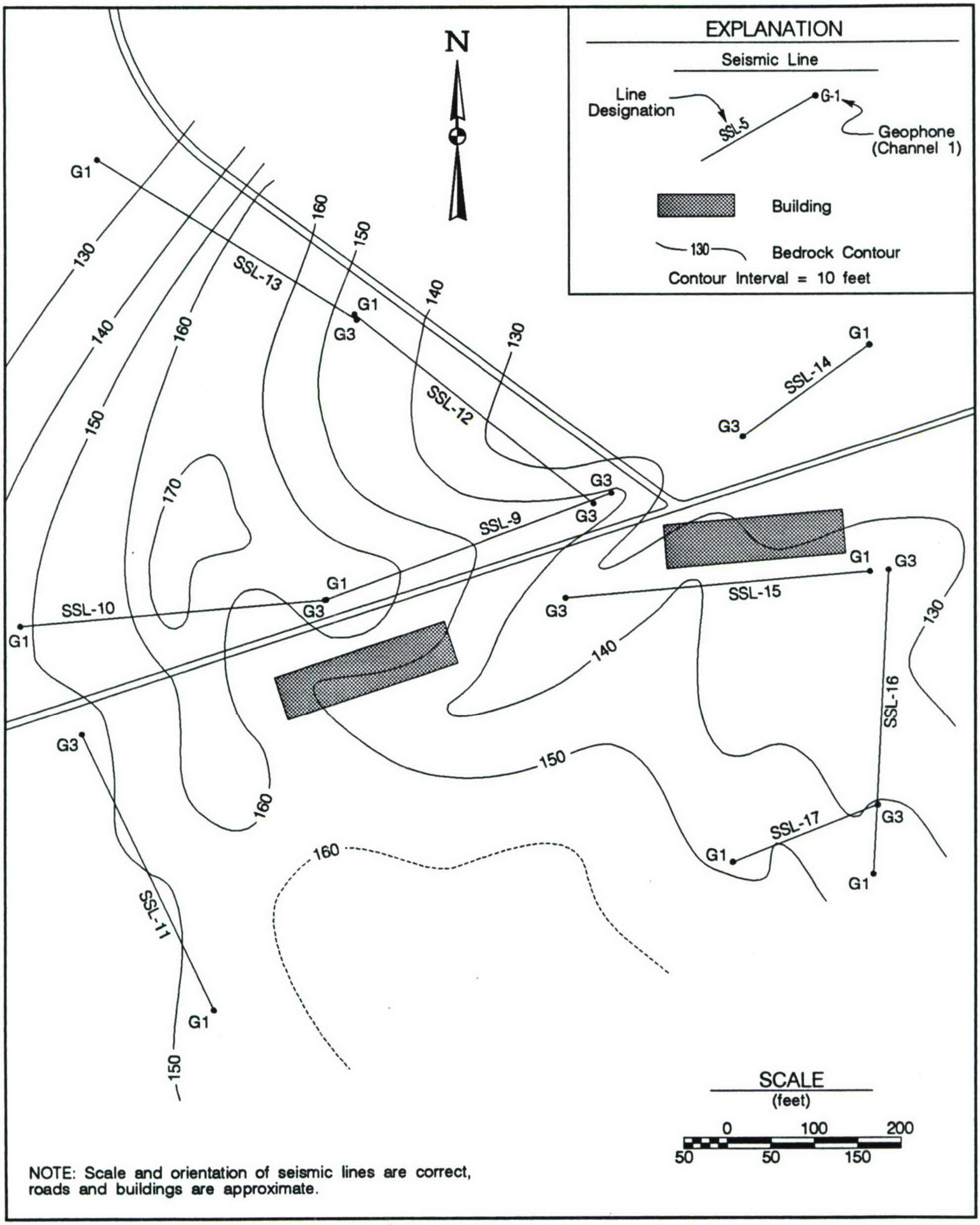

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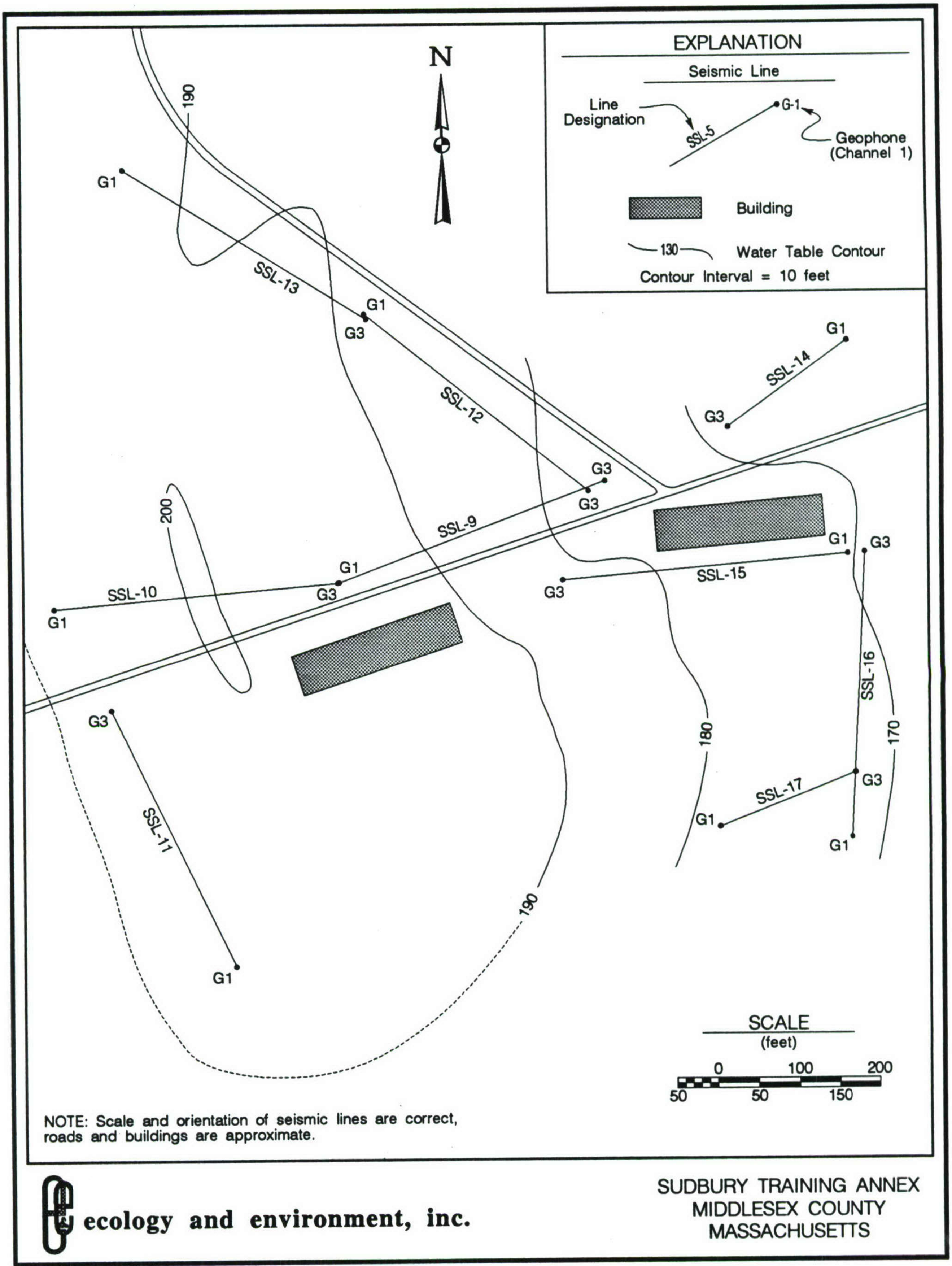
Figure 3-7: P36/P37 STUDY AREA - GENERALIZED BEDROCK CONTOUR MAP



Prepared By: L.J.BAER

Figure 3-8: P36/P37 STUDY AREA - GENERALIZED GROUNDWATER CONTOUR MAP

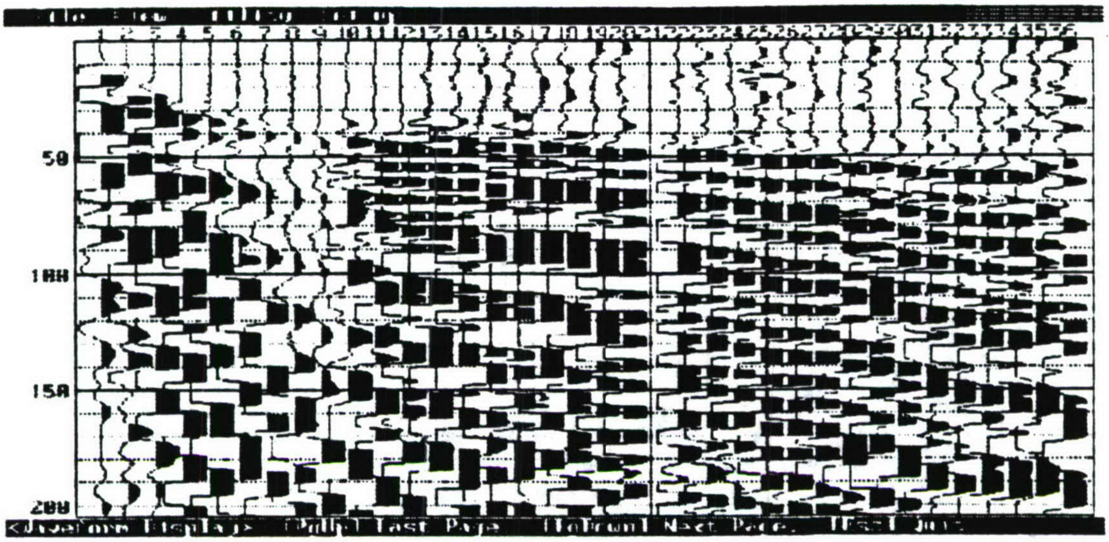
sud36wtr.cdr

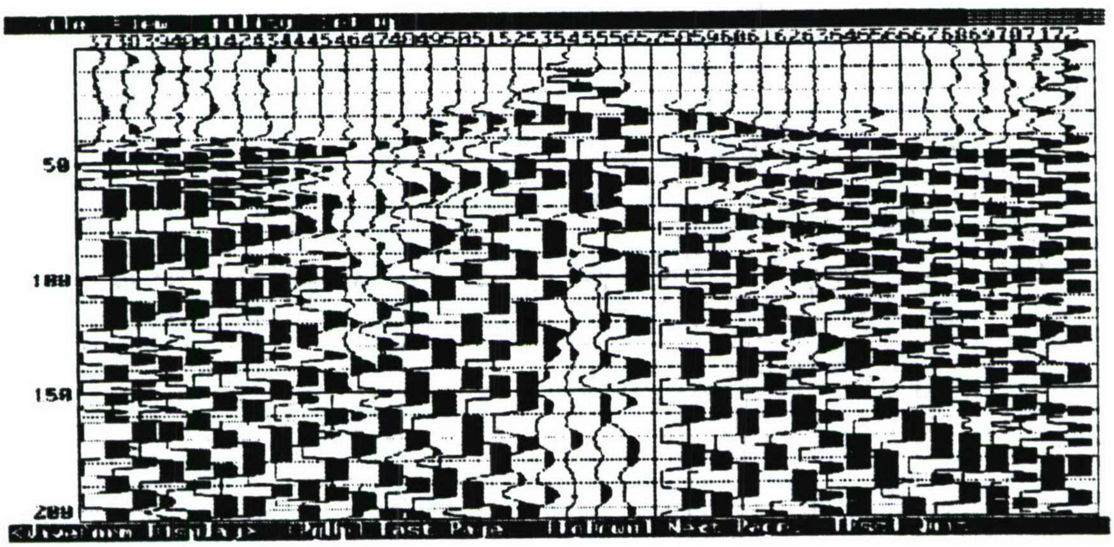
APPENDIX E

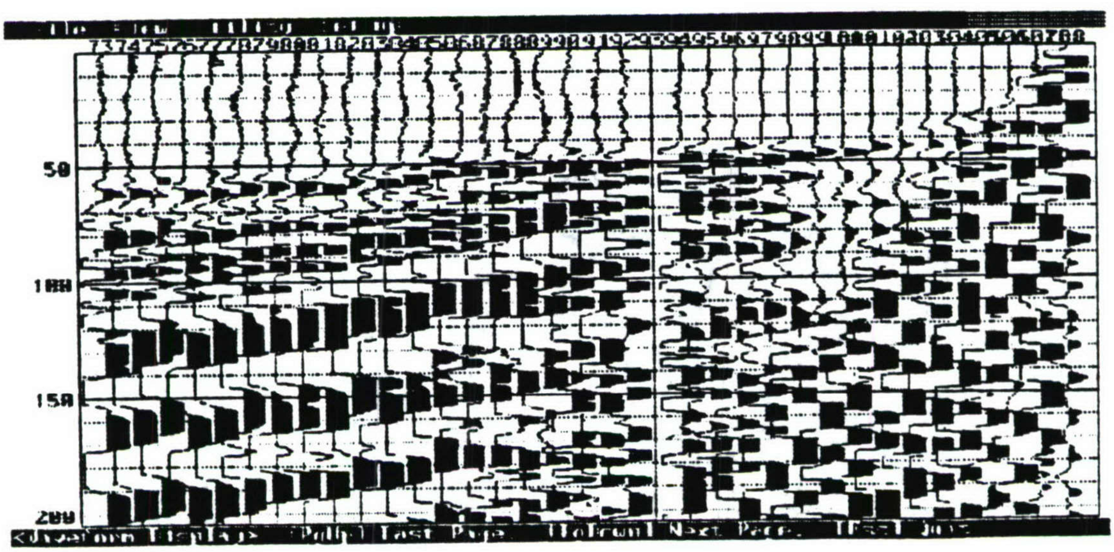
ATTACHMENT A

P11/P13 STUDY AREAS SEISMIC DATA

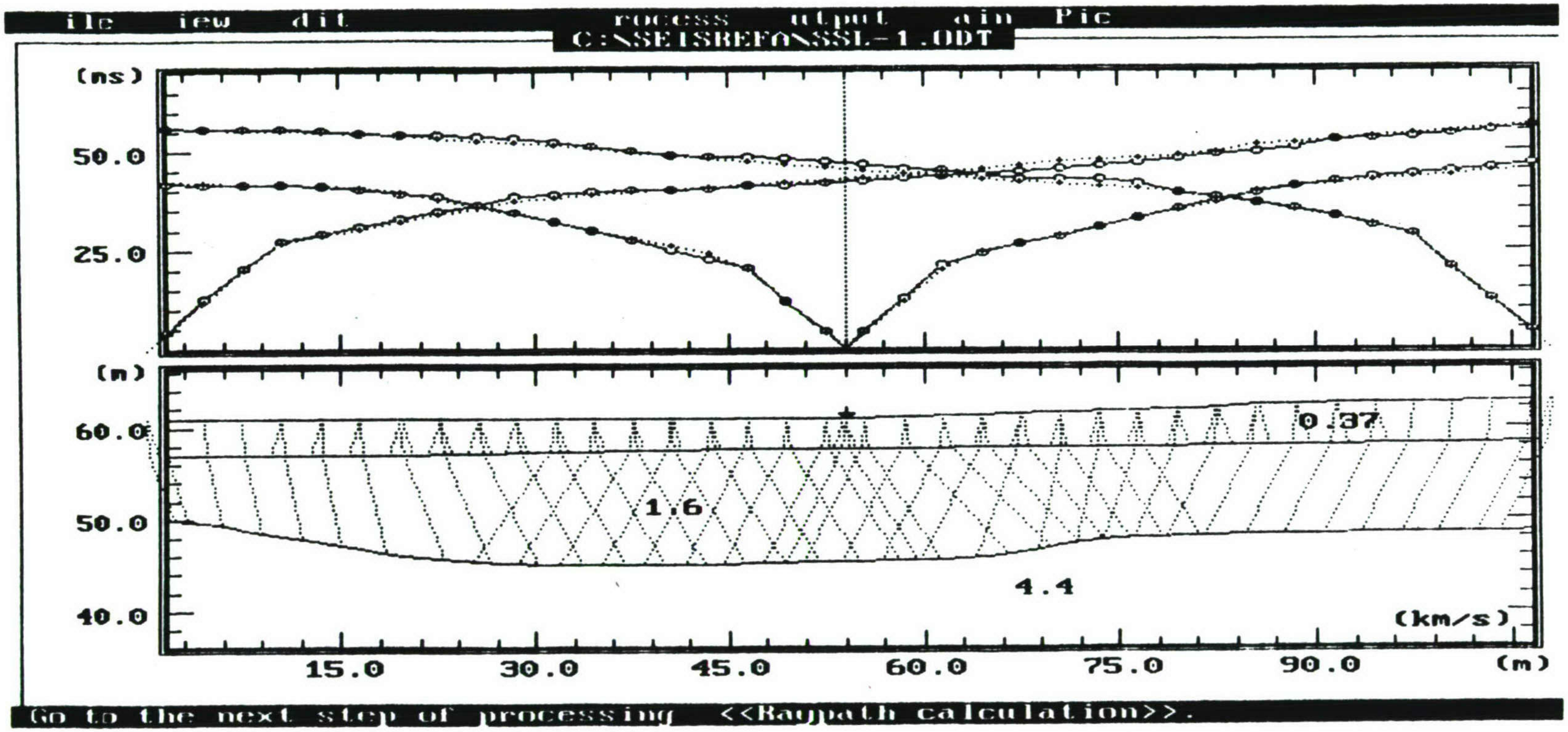
SSL-1





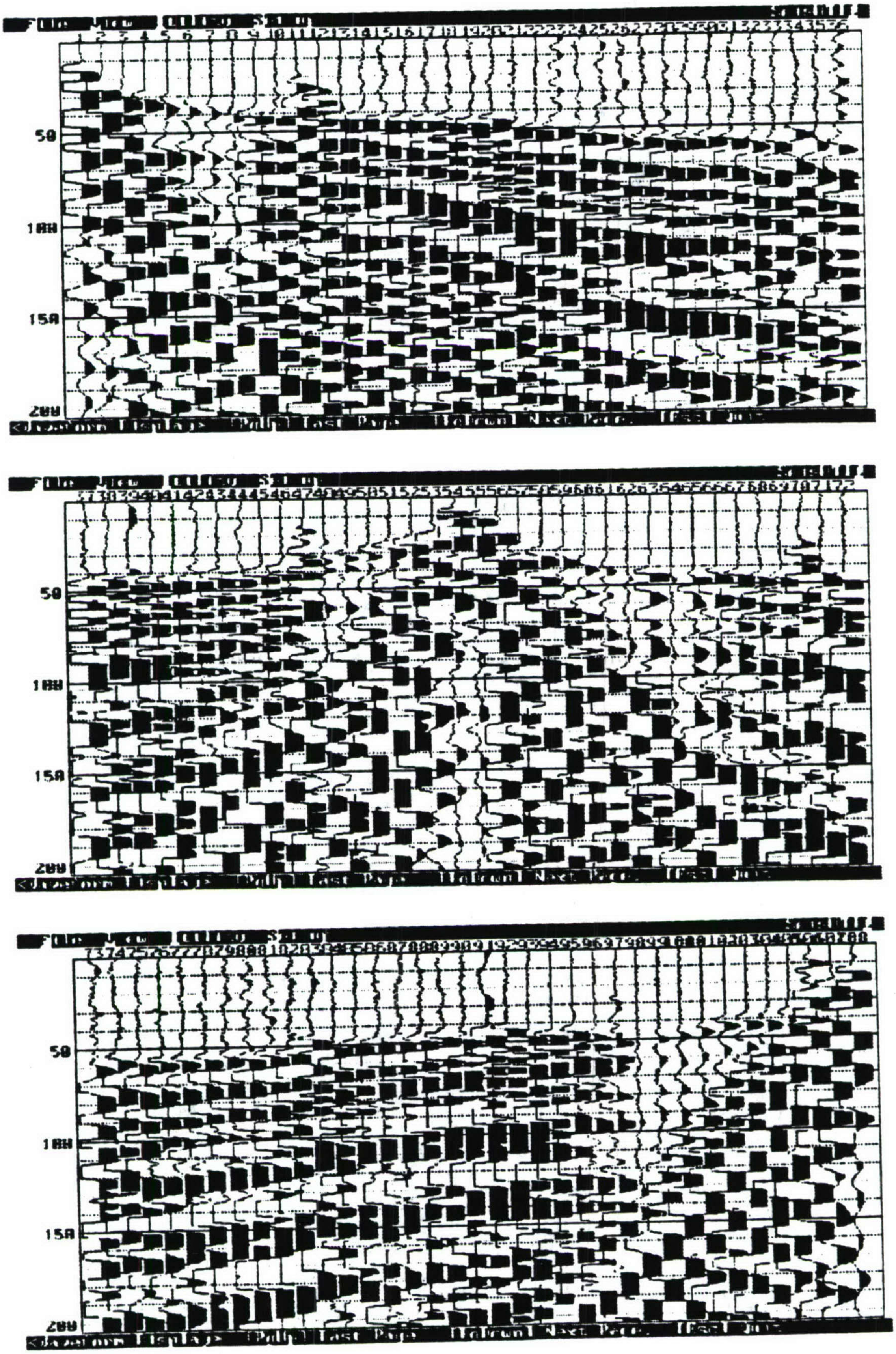


P11/P13 STUDY AREA - SEISMIC LINE SSL-1



P11/P13 STUDY AREA - SEISMIC LINE SSL-1

SSL-2



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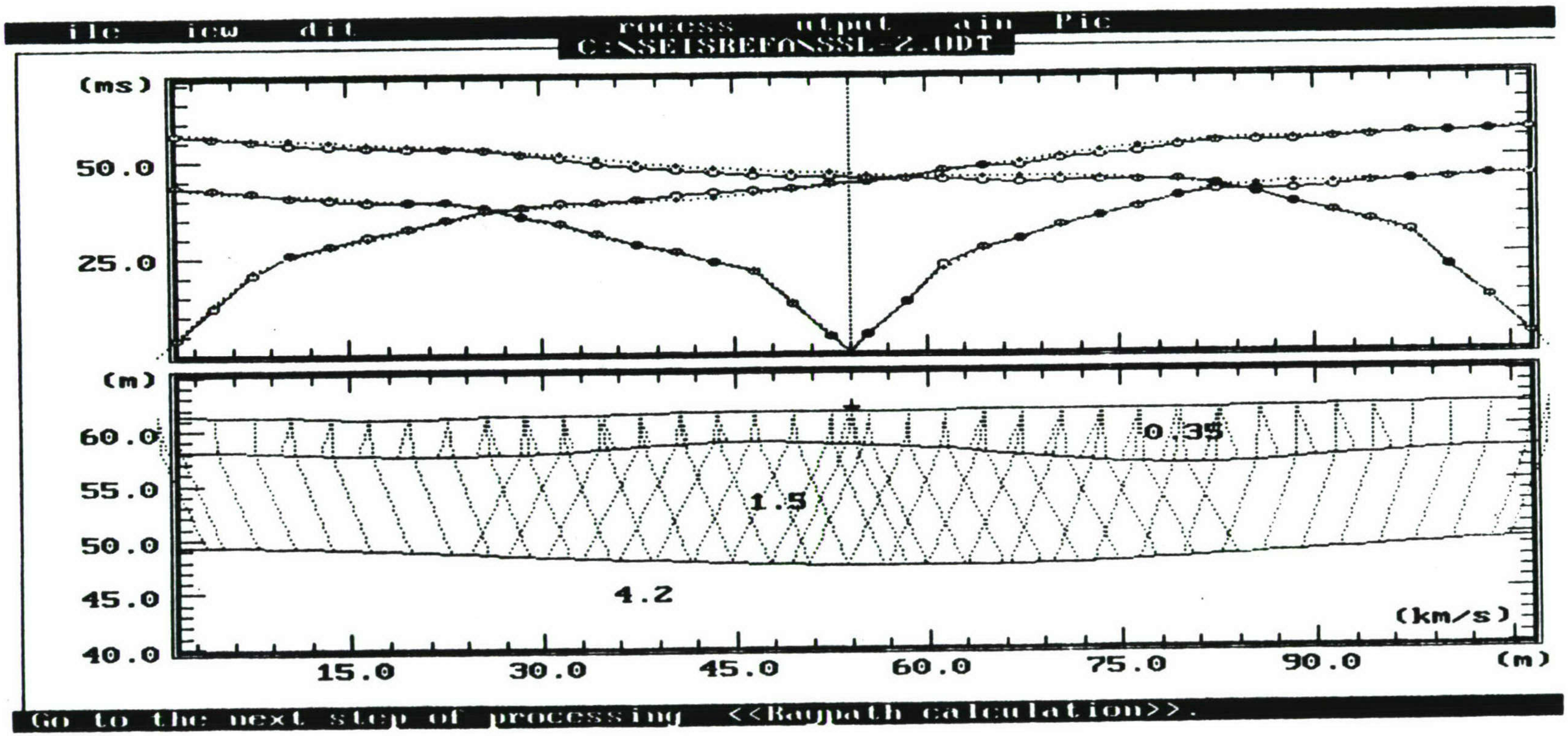
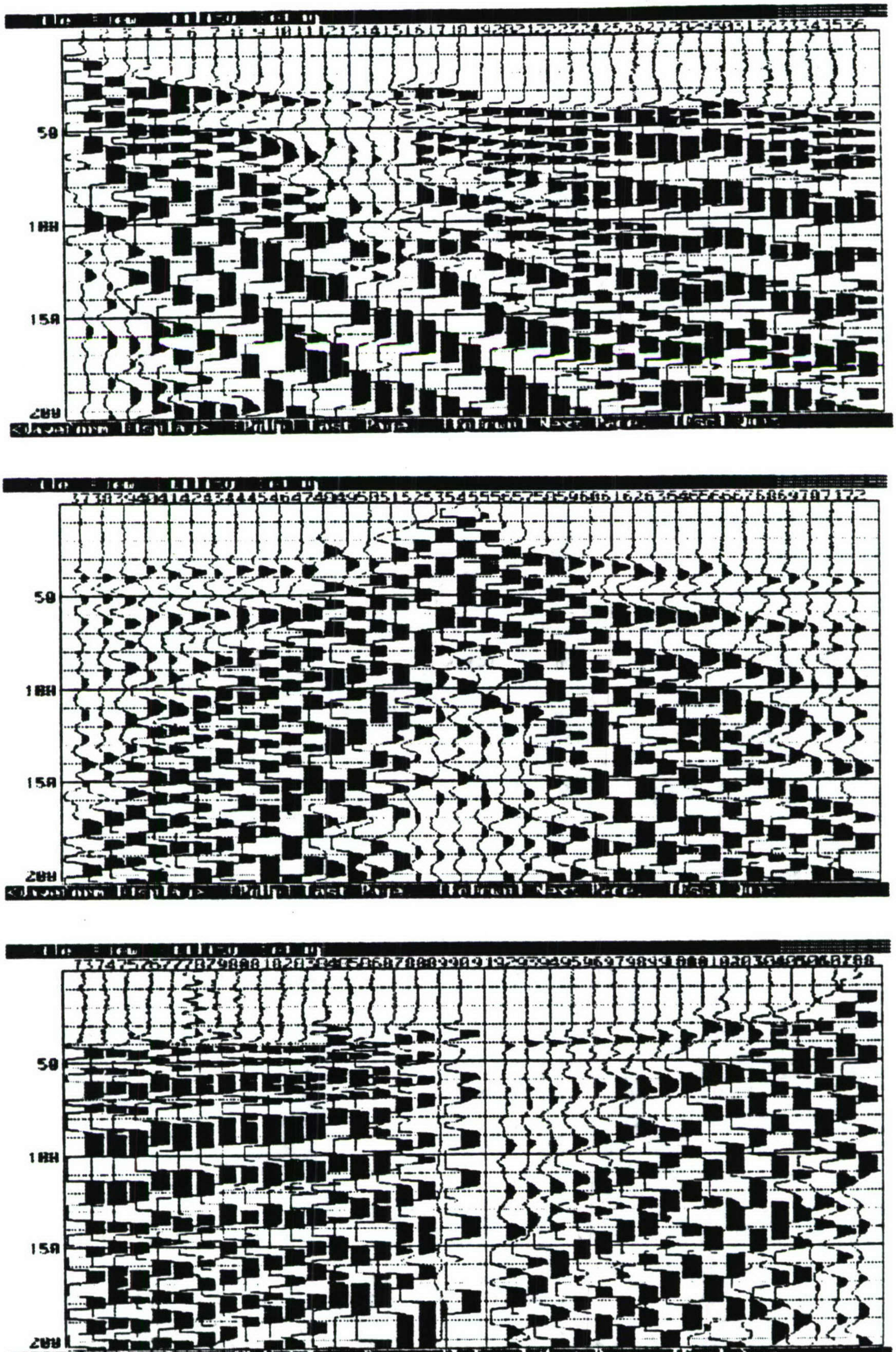


P11/P13 STUDY AREA – SEISMIC LINE SSL-2

SSL-3



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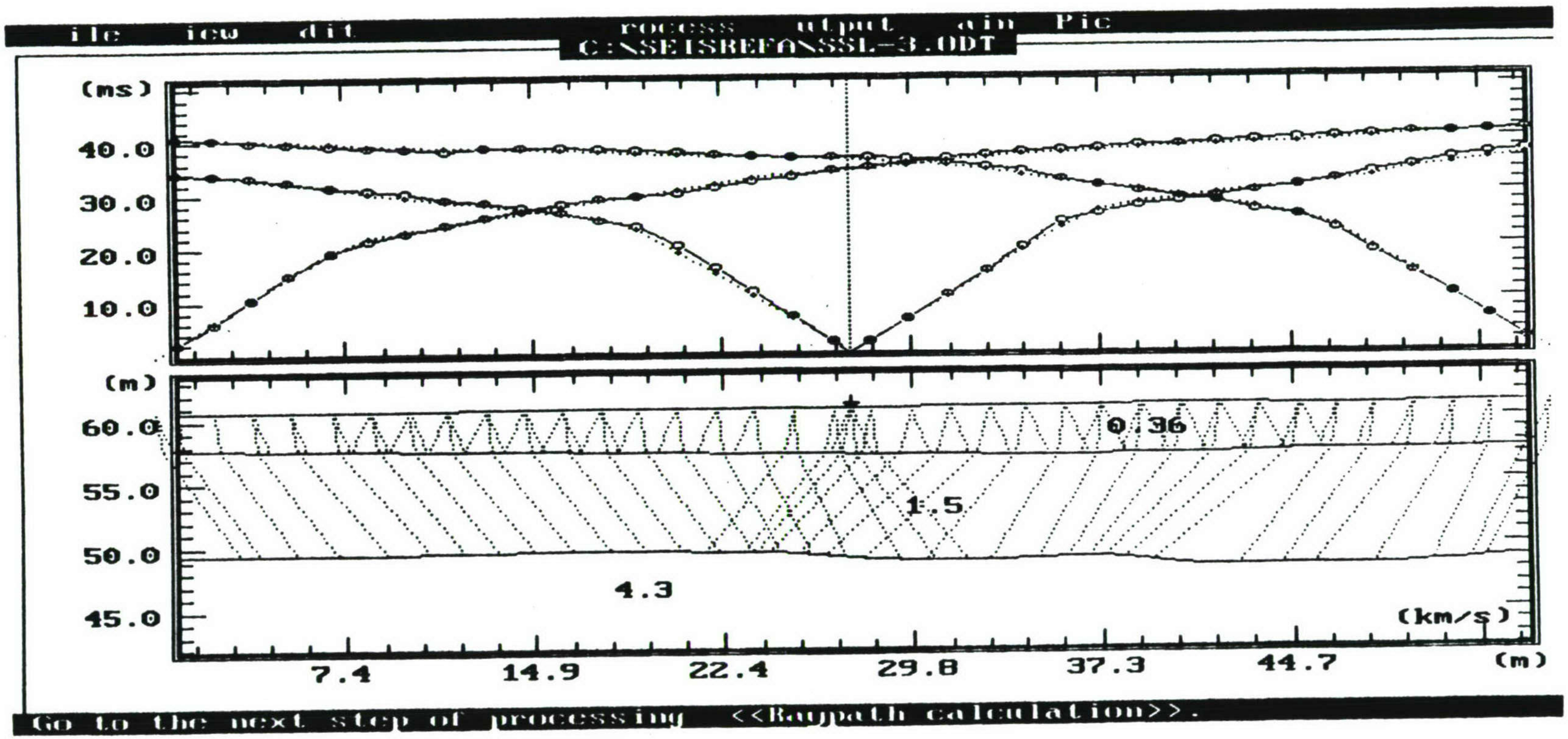
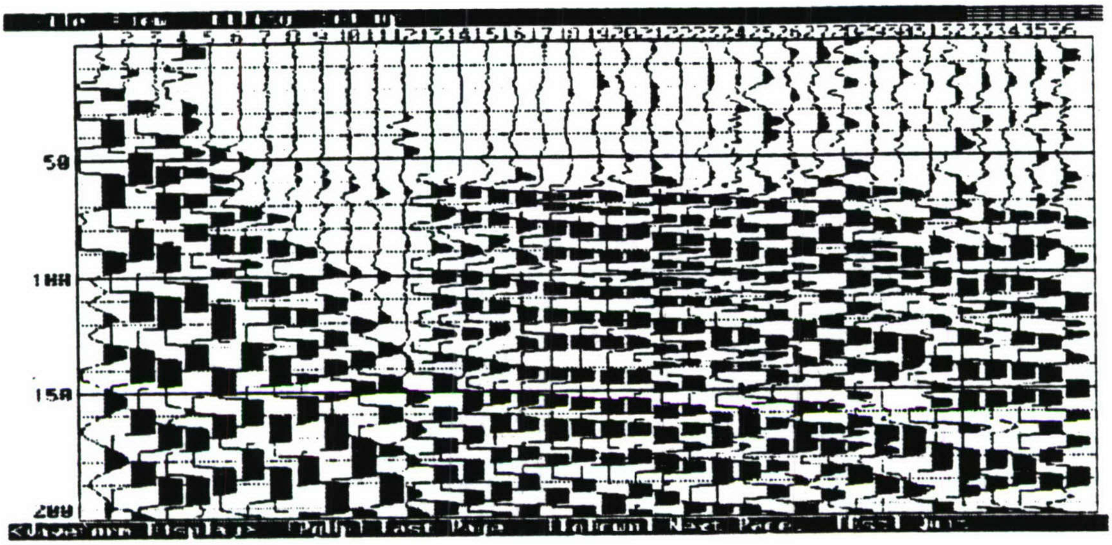
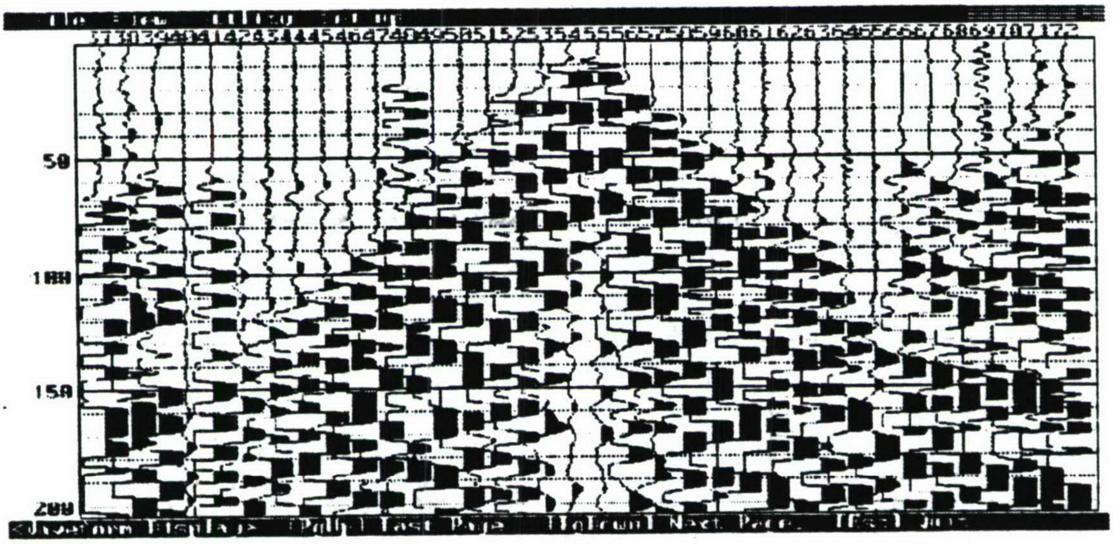
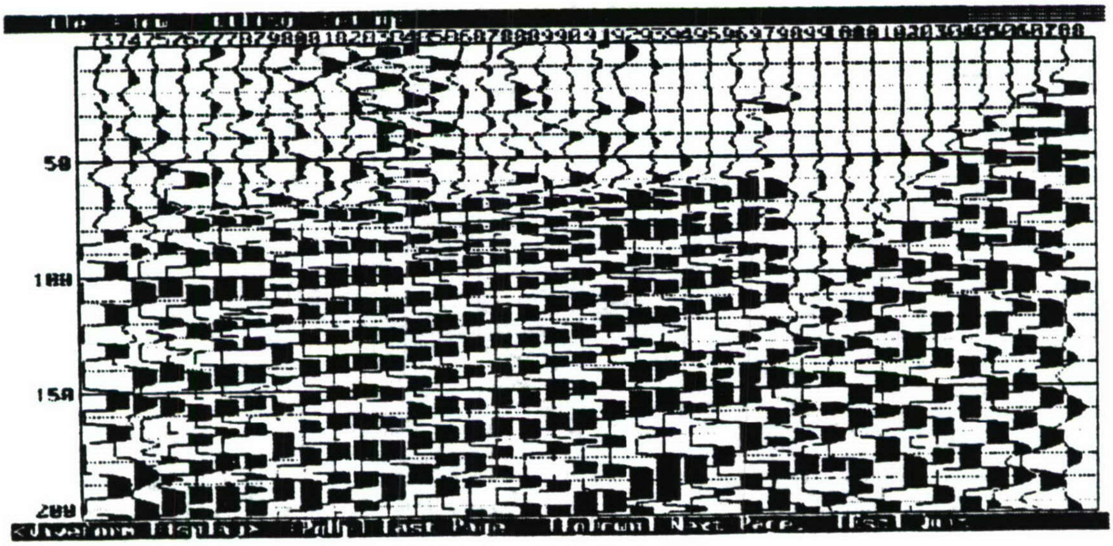


P11/P13 STUDY AREA - SEISMIC LINE SSL-3

SSL-4







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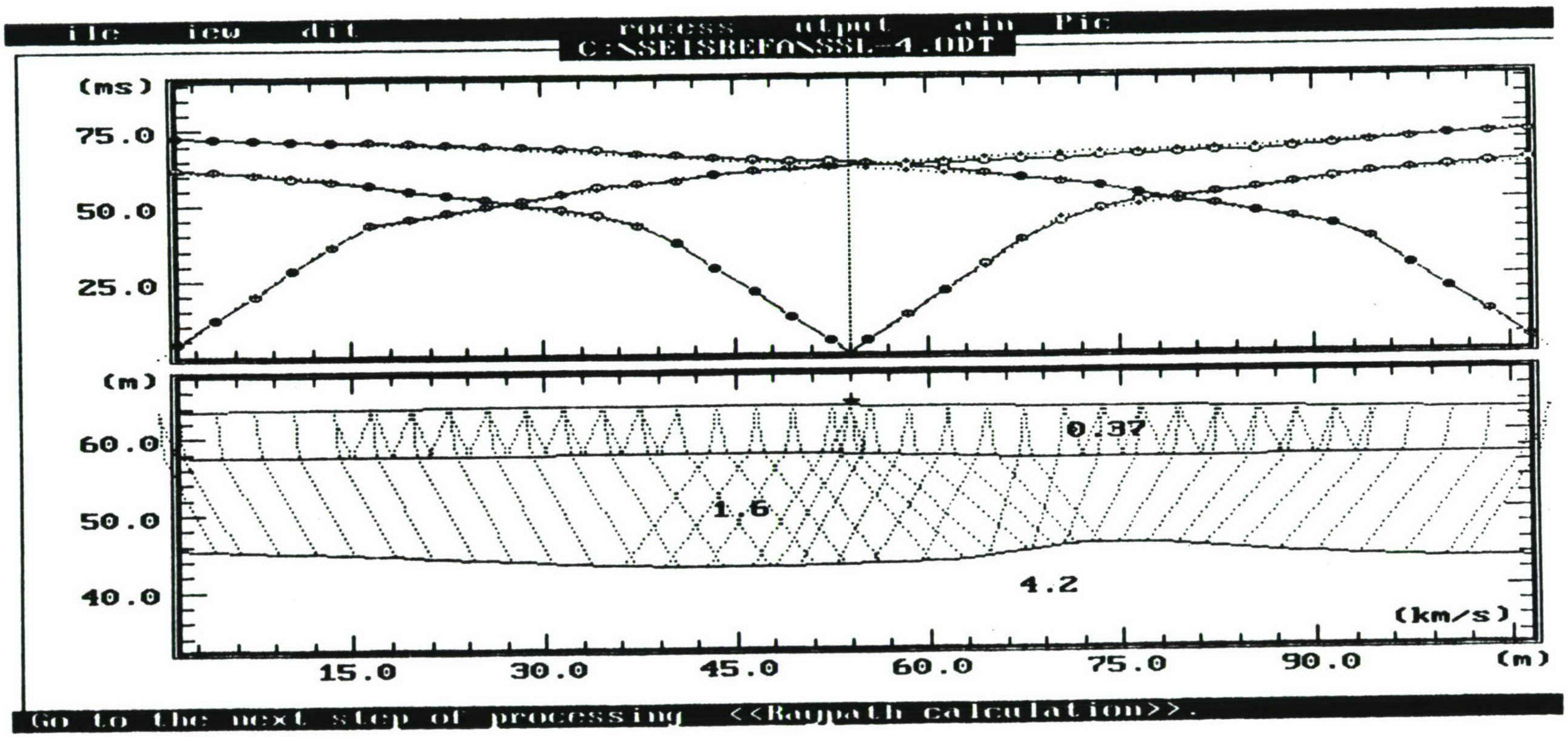
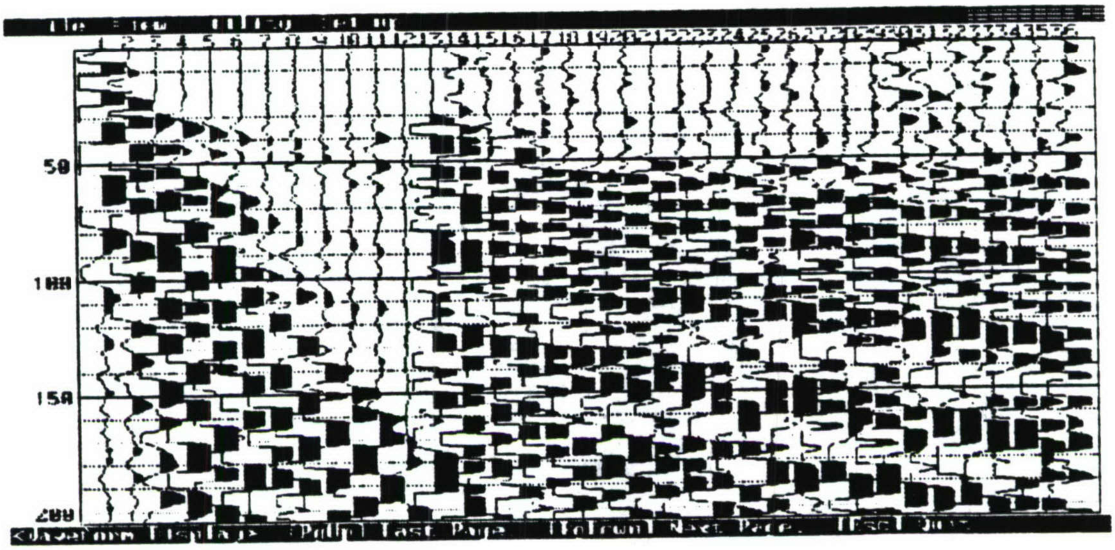
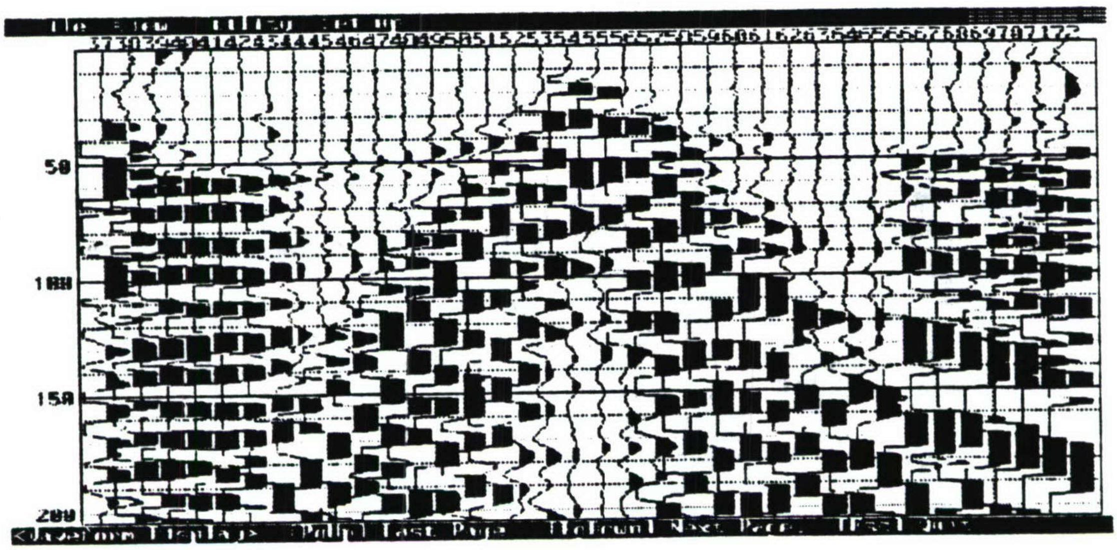
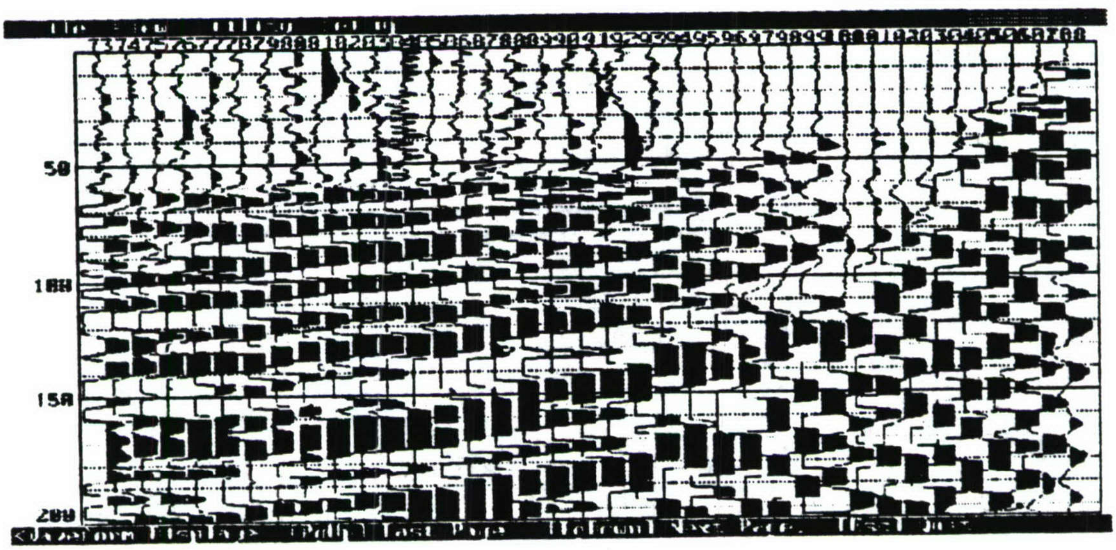


P11/P13 STUDY AREA - SEISMIC LINE SSL-4

SSL-5







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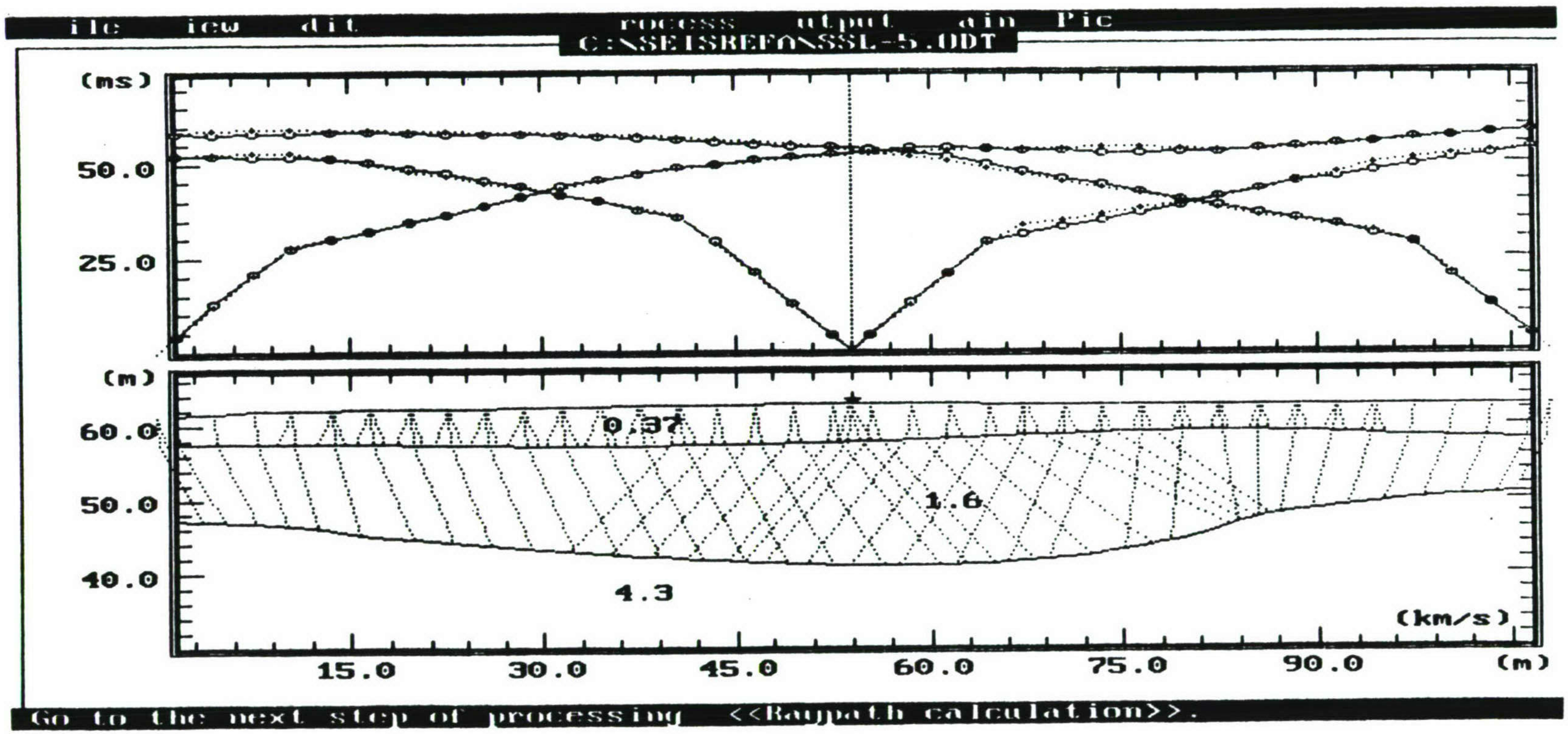

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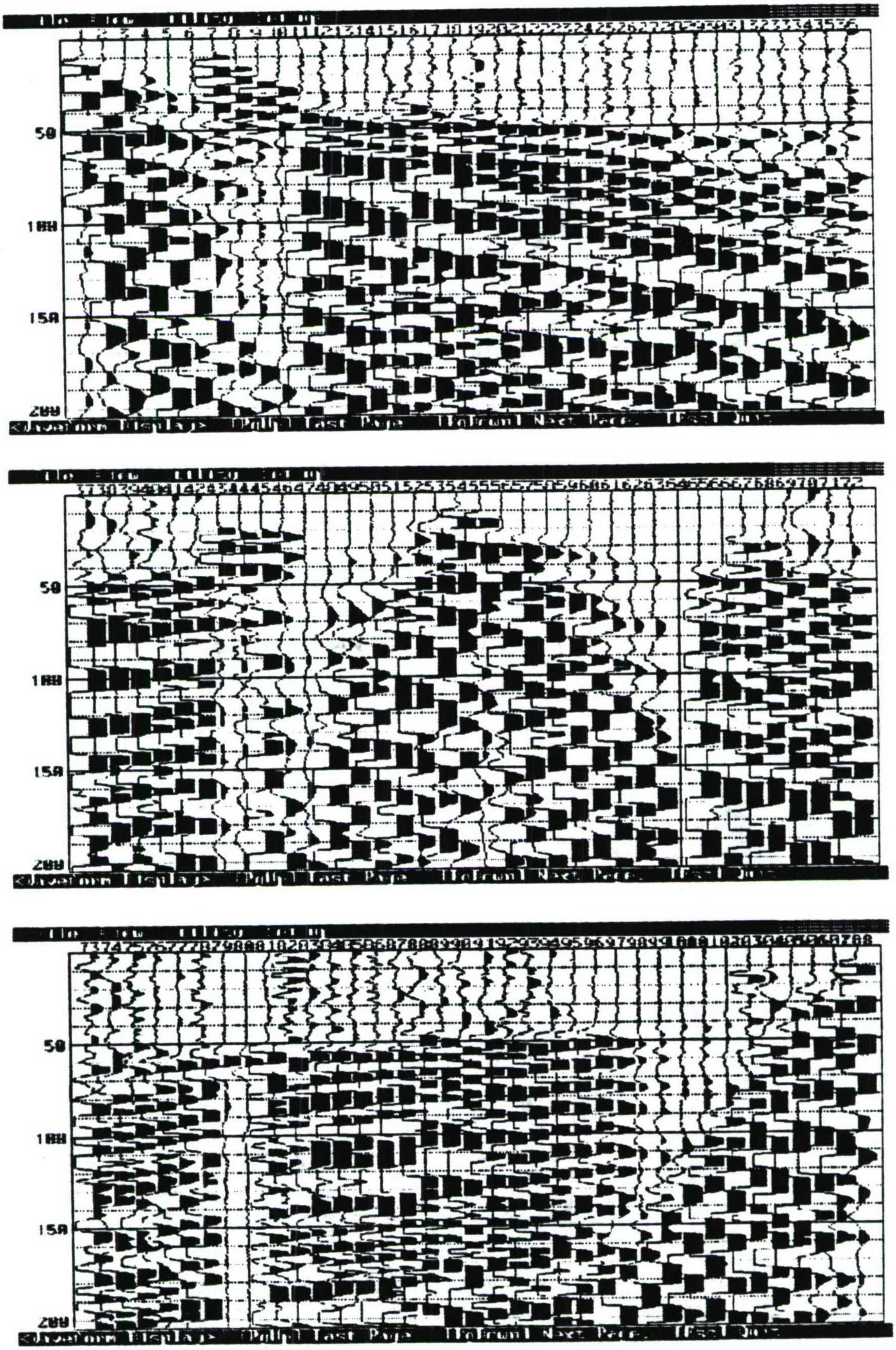
SSL-6



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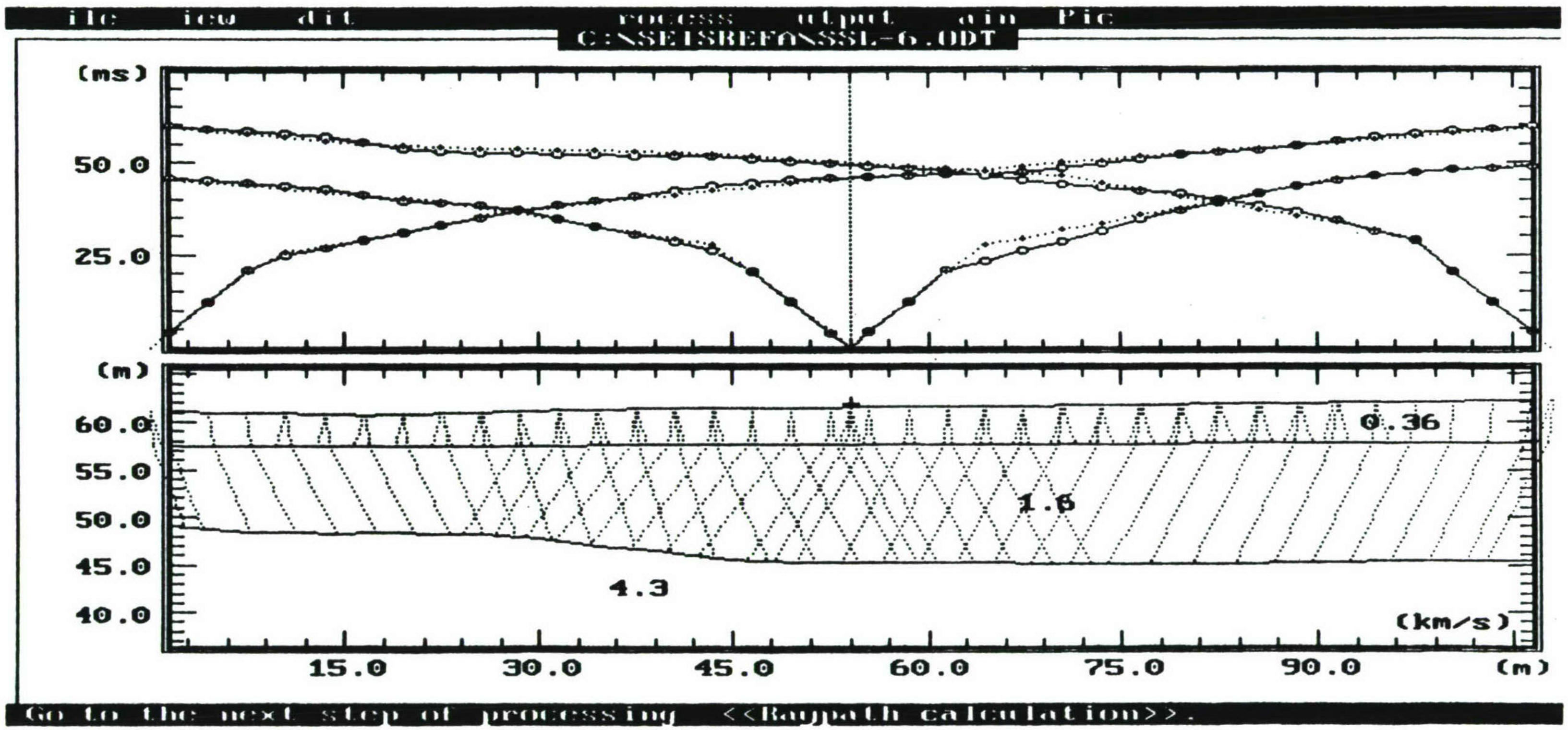

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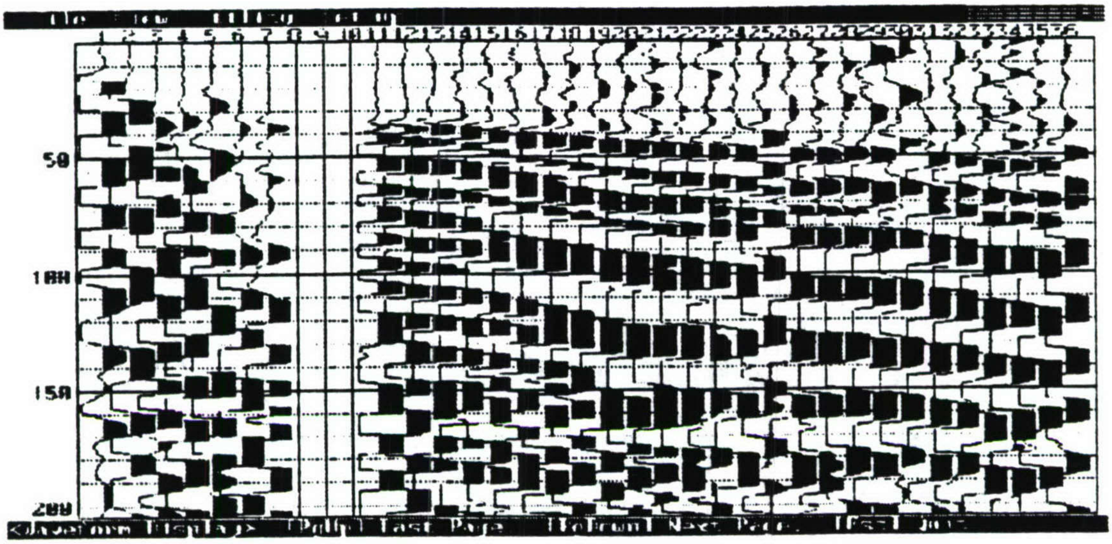
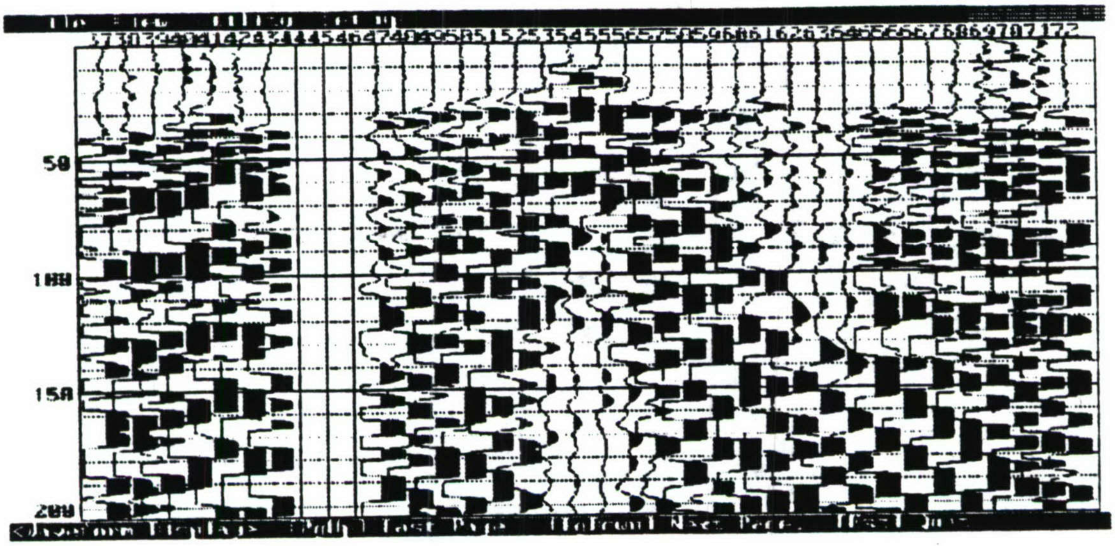
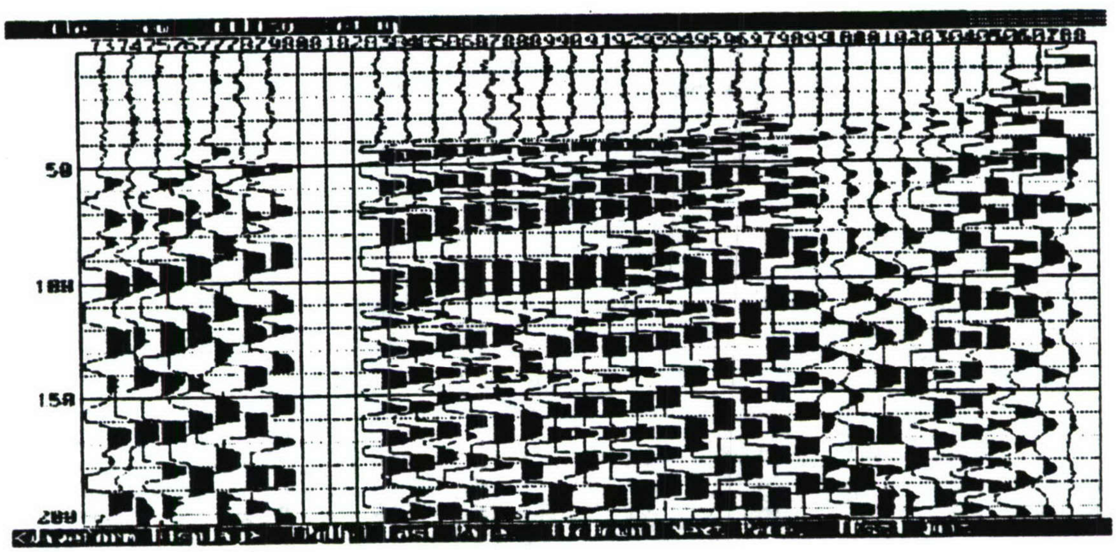
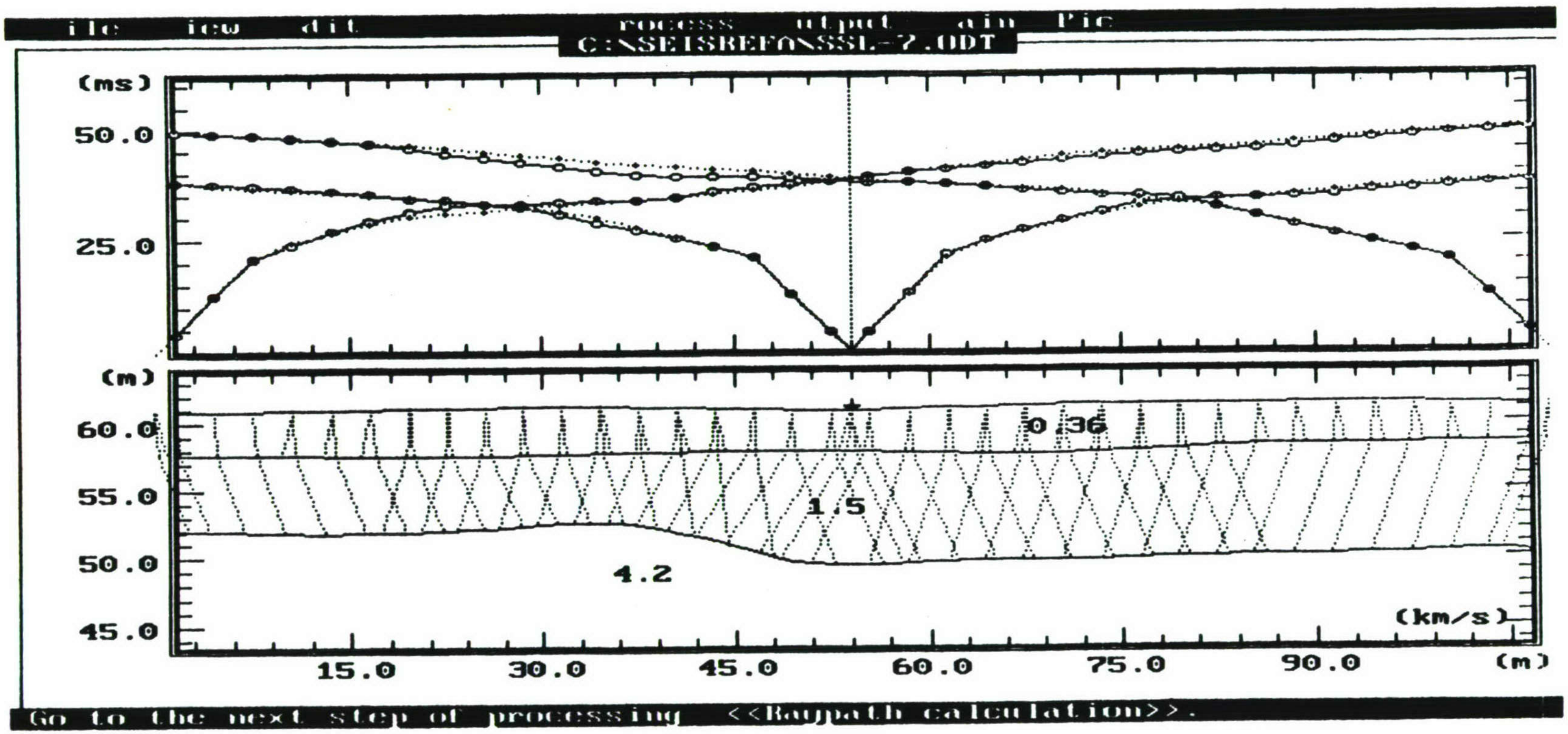
SSL-7





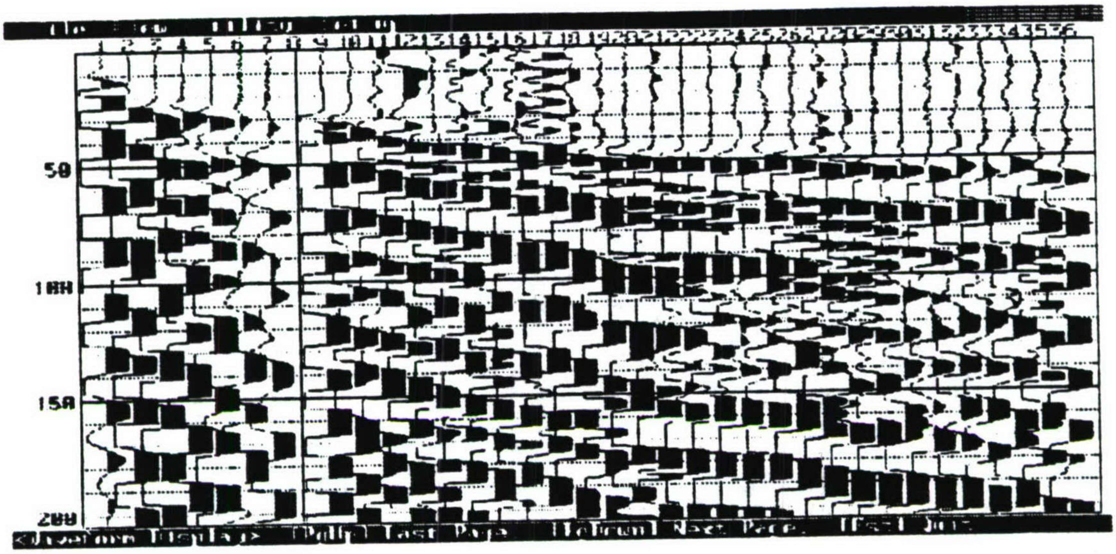


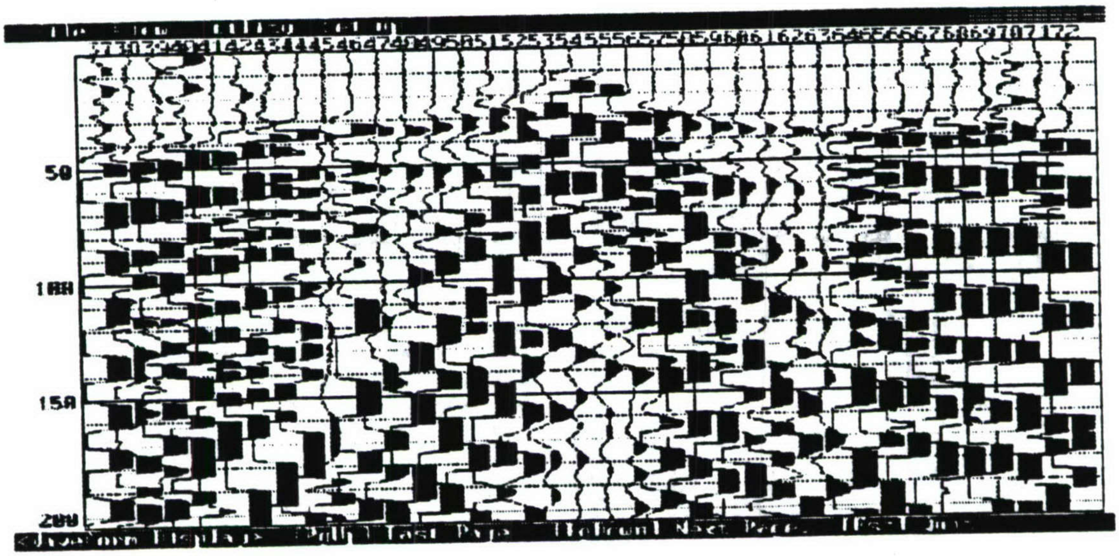
P11/P13 STUDY AREA – SEISMIC LINE SSL-7

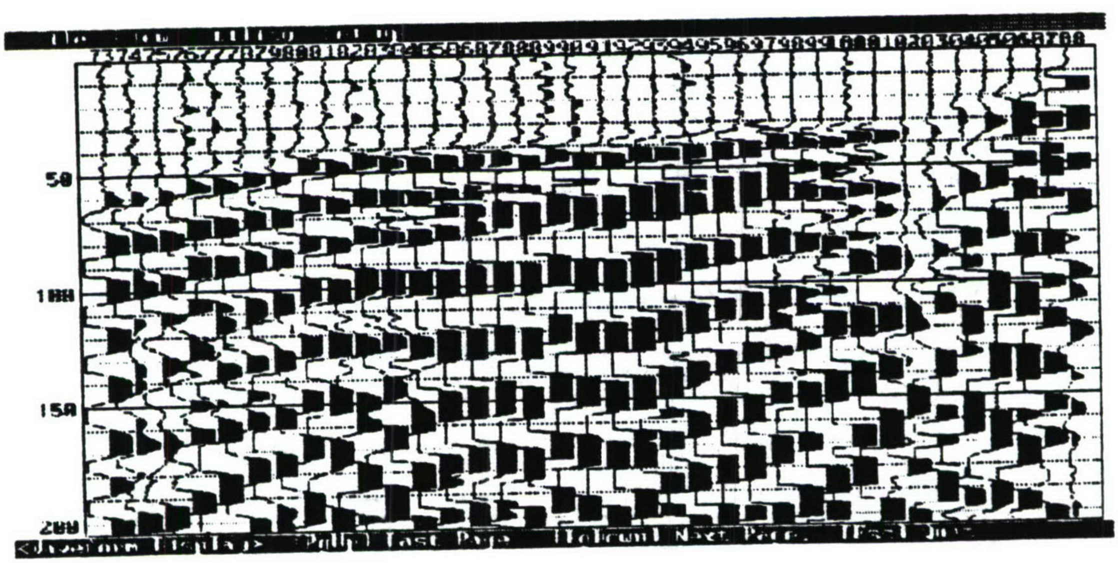


P11/P13 STUDY AREA – SEISMIC LINE SSL-7

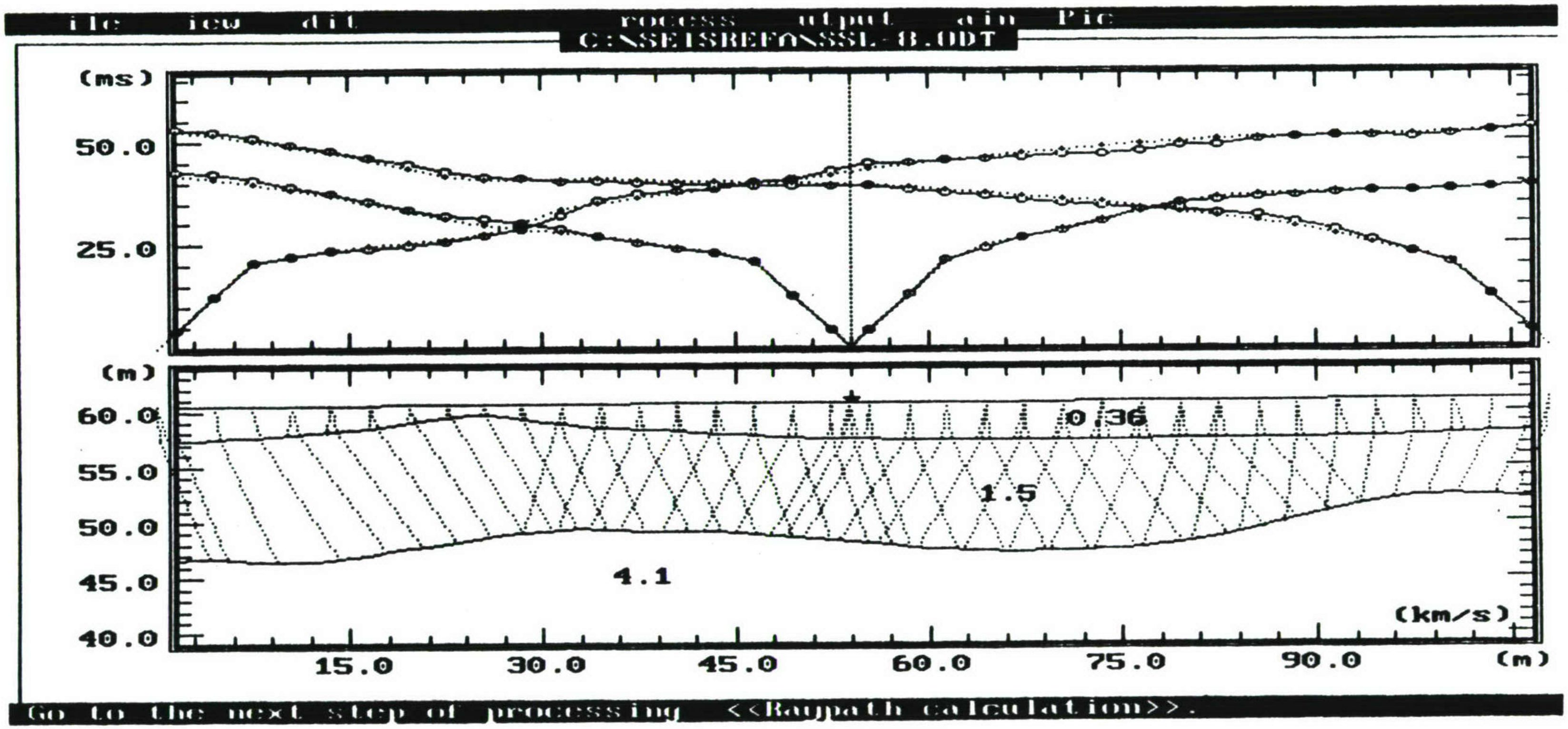
SSL-8







P11/P13 STUDY AREA - SEISMIC LINE SSL-8



P11/P13 STUDY AREA - SEISMIC LINE SSL-8

APPENDIX E

ATTACHMENT B

P13 STUDY AREA
RAW EM & MAG DATA

UC6Ø61 8-11-93 UC6Ø61 8-11-93 47

Station N	Station E	V-Dipole N-S	V-Dipole E-W	H-Dipole N-S	H-Dipole E-W	Magnetometer Readings	Comments
1+40	1+40	3.0	2.7	2.9	3.0	54537	
+60	"	3.2	3.0	2.6	3.1	54532	
+80	"	3.2	3.2	3.0	3.0	54531	
2+00	"	3.3	3.4	3.3	3.3	54529	
+20	"	3.4	3.4	3.3	3.4	54528	Stressed Veg (?) @ N2+19
+40	"	3.7	3.4	3.4	3.4	54528	
+60	"	4.0	3.5	3.4	3.2	54519	Stressed Veg (?) @ N2+57
+80	"	3.8	3.8	3.6	3.3	54514	
3+00	"	4.8	4.4	3.8	3.6	54513	
1+00	1+00	—	—	—	—	54495.5	12:26, Base Station
1+00	1+00	—	—	—	—	54508.0	13:51, Base Station
Ø+80	1+60	5.2	4.8	5.0	4.9	54527	
1+00	"	5.3	5.0	5.3	5.4	54551	
+20	"	5.0	5.1	5.2	5.0	54546	
+40	"	5.1	5.2	5.2	5.3	54544	
+60	"	5.2	5.2	5.2	5.5	54547	
+80	"	5.4	5.3	5.4	5.5	54550	
2+00	"	5.5	5.4	5.6	5.5	54548	
+20	"	5.4	5.4	5.5	5.4	54548	
+40	"	5.4	5.1	6.0	5.5	54551	
+60	"	5.6	5.7	5.6	5.5	54543	Stressed Veg (?) @ N1+51
+80	"	6.1	6.0	6.0	5.4	54534	Manhole (?) @ N2+75, E1+69
3+00	"	6.4	6.2	5.8	5.9	54483	
1+00	1+00	—	—	—	—	54518.0	14:05, Base Station
1+80	1+40	5.2	5.2	5.2	5.4	—	EM Check, 1400 *
1+00	1+80	4.8	4.8	5.2	5.0	54557	
+20	"	5.0	4.9	5.2	5.2	54555	
+40	"	5.1	5.0	5.1	5.4	54559	

P13 STUDY AREA - EM AND MAGNETOMETER DATA, SHEET 1 of 3

UC6Ø61 P13 DATA 8-11-93 UC6Ø61 8-11-93

STATION N	STATION E	V-Dipole N-S	V-Dipole E-W	H-Dipole N-S	H-Dipole E-W	Magnetometer Reading	Comments
0+60	1+00	3.4	3.2	3.2	3.0	54499	
+80	"	3.1	3.0	3.0	3.0	54494	
1+00	"	3.3	3.2	3.2	3.3	54488.2	11:25, Base station
+20	"	3.3	3.2	3.0	3.2	54494	
+40	"	3.4	3.4	3.4	3.5	54511	
+60	"	3.3	3.1	3.4	3.4	54525	
+80	"	3.4	3.3	3.6	3.2	54505	
2+00	"	3.5	3.2	3.2	3.4	54552	P.Pole @ N2+00, E 1+05
+20	"	3.5	3.5	3.8	3.6	54553	
+40	"	3.7	3.6	3.8	3.4	54473	
+60	"	4.0	4.0	3.8	3.5	54477	
+80	"	4.4	4.2	3.6	3.4	54449	
3+00	"	4.5	4.6	3.6	4.0	54412	
1+00	1+00					54490.6	11:48, Base station
0+80	1+20	3.0	2.8	2.8	2.8	54508	
1+00	"	3.0	3.0	3.0	3.1	54512	
+20	"	3.0	3.0	3.0	3.0	54517	
+40	"	3.0	2.9	3.4	3.1	54531	
+60	"	3.2	3.0	3.4	3.1	54523	
+80	"	3.2	3.1	3.2	3.0	54517	
2+00	"	3.5	3.0	3.4	3.2	54512	Stressed Veg (?)
+20	"	3.8	3.4	3.4	3.3	54506	
+40	"	3.8	3.5	3.4	3.0	54510	
+60	"	3.8	3.8	3.3	3.2	54507	
+80	"	4.0	4.0	3.1	3.3	54497	
3+00	"	5.4	4.8	3.8	3.8	54521	
1+00	1+00					54493.0	12:18, Base station
0+80	1+40	2.6	2.3	2.6	2.2	54516	
1+00	"	2.8	2.6	2.8	2.6	54525	
+20	"	3.0	2.6	3.0	3.0	54537	

P13 STUDY AREA - EM AND MAGNETOMETER DATA, SHEET 2 of 3

UC6061 8-11-93 UC6061 8-11-93

P13 DATA (Con't)

Station N	Station E	V-Dipole N-S	V-Dipole E-W	H-Dipole N-S	H-Dipole E-W	Magnetometer Reading	Comments
1+60	1+80	5.4	5.1	5.4	5.4	54561	
+80	"	5.4	5.4	5.4	5.4	54567	
2+00	"	5.7	5.6	5.6	5.4	54568	
+20	"	5.8	5.5	5.6	5.4	54562	
+40	"	5.6	5.4	5.4	5.4	54561	
+60	"	5.4	5.0	5.6	5.6	54565	MH(?) has <ø readings
+80	"	6.4	7.0	5.8	5.6	54532	
3+00	"	6.0	6.1	5.6	5.5	54499	
1+00	1+00	5.6	5.6	5.4	5.4	54527.0	14:50, Base station
1+00	2+00	5.3	5.3	5.3	5.4	54562	
+20	"	5.1	5.0	5.5	5.5	54569	
+40	"	5.0	5.1	5.5	5.8	54569	
+60	"	5.2	5.4	5.6	5.4	54571	
+80	"	5.1	5.0	5.4	5.5	54571	
2+00	"	5.3	5.3	5.5	5.6	54573	
+20	"	5.5	5.4	5.5	5.8	54573	
+40	"	5.0	5.4	6.2	6.0	54577	
+60	"	5.5	5.4	5.7	5.8	54565	
+80	"	5.8	5.6	5.9	5.8	54565	
3+00	"	6.1	6.0	6.2	5.9	54533	
1+00	1+00					54523.4	15:25, Base Station Top of slope
1+20	2+20	5.7	5.6	6.5	6.2	54569	
+40	"	5.6	5.5	6.2	5.8	54575	
+60	"	5.5	5.6	6.2	6.0	54574	
+80	"	5.9	5.6	6.0	6.2	54573	
2+00	"	5.8	5.5	6.1	5.9	54576	
+20	"	5.9	5.7	6.4	6.2	54583	
+40	"	6.0	5.9	6.0	6.1	54568	
+60	"	5.9	5.7	6.2	6.2	54573	
+80	"	6.2	6.0	6.0	6.1	54580	
3+00	"	6.3	6.0	6.2	6.3	54586	

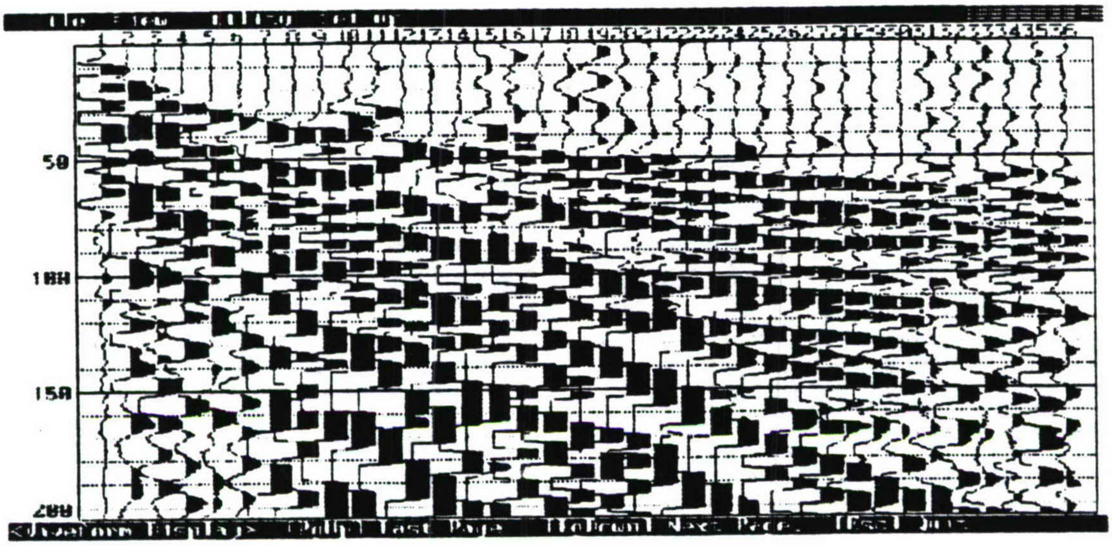
P13 STUDY AREA – EM AND MAGNETOMETER DATA, SHEET 3 of 3

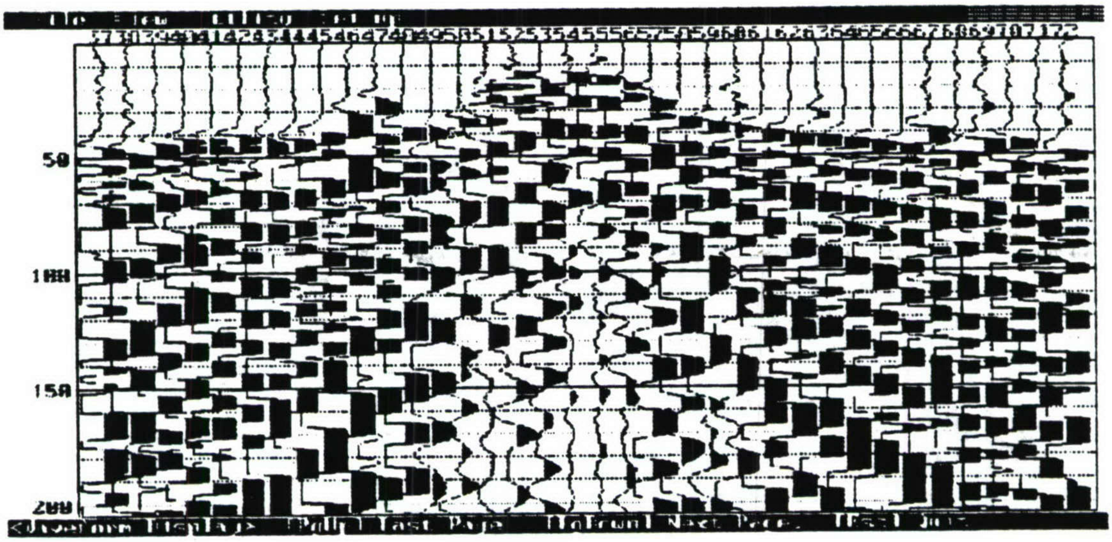
APPENDIX E

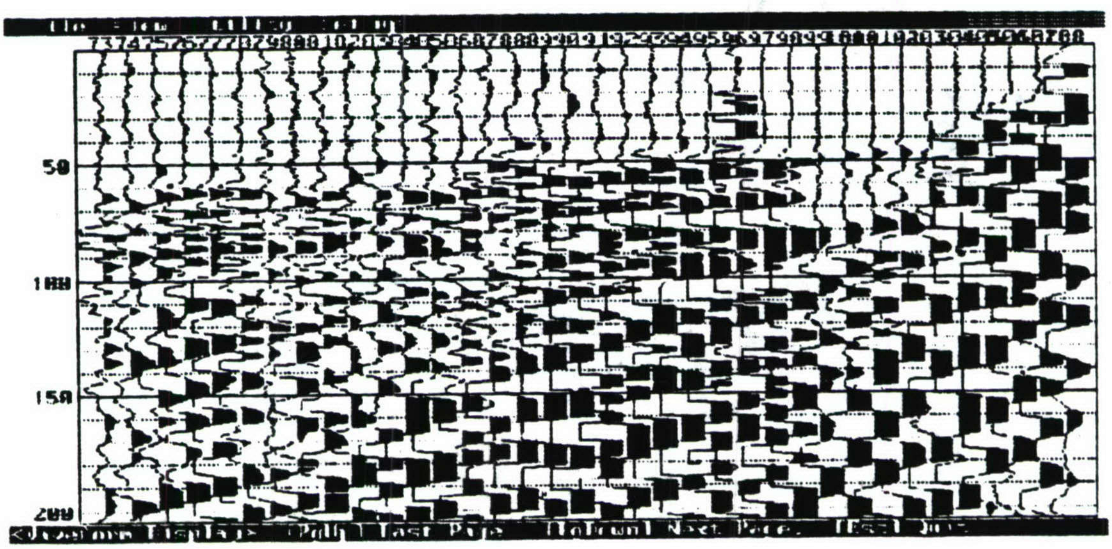
ATTACHMENT C

**P36/P37 STUDY AREAS
SEISMIC DATA**

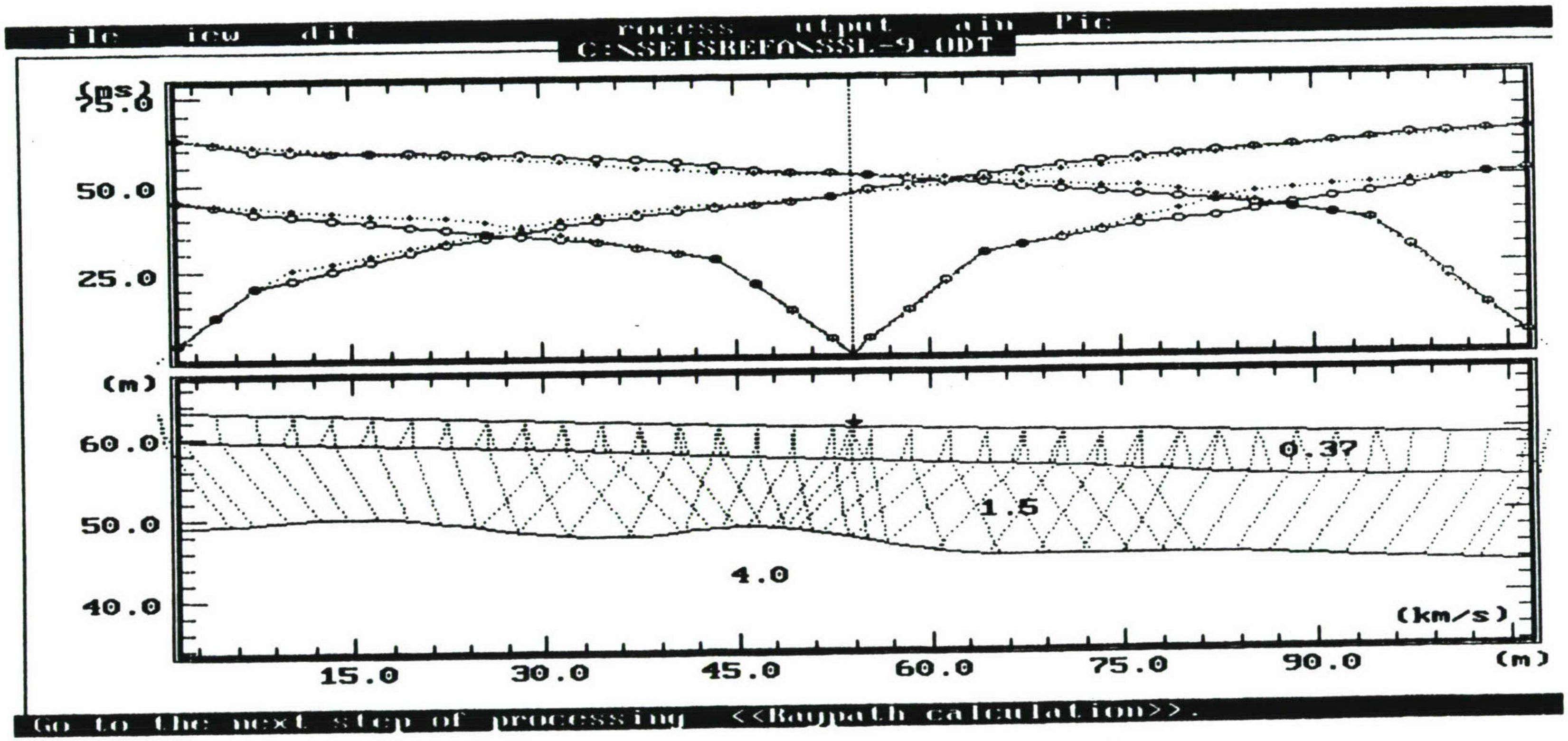
SSL-9





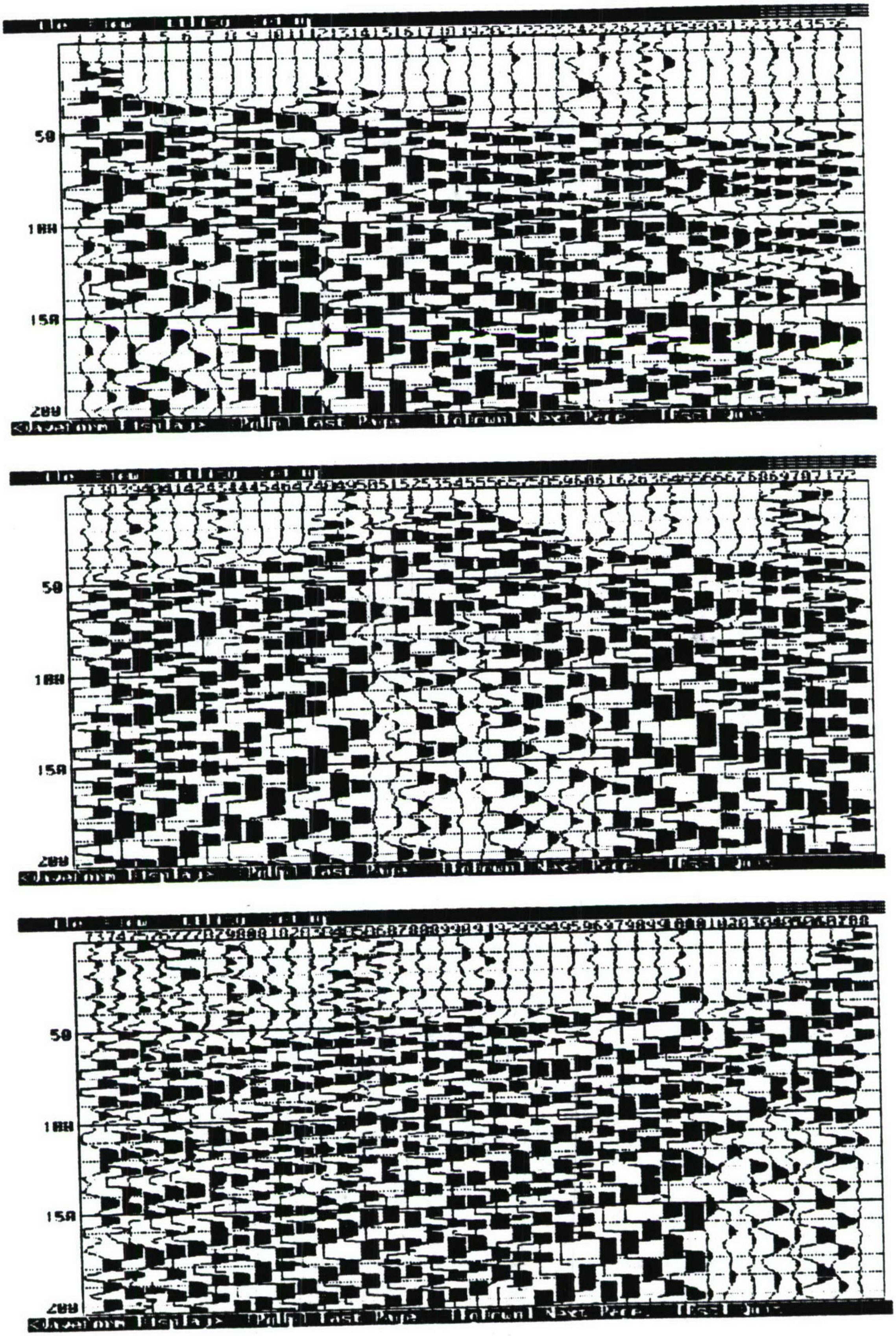


P36/P37 STUDY AREA - SEISMIC LINE SSL-9

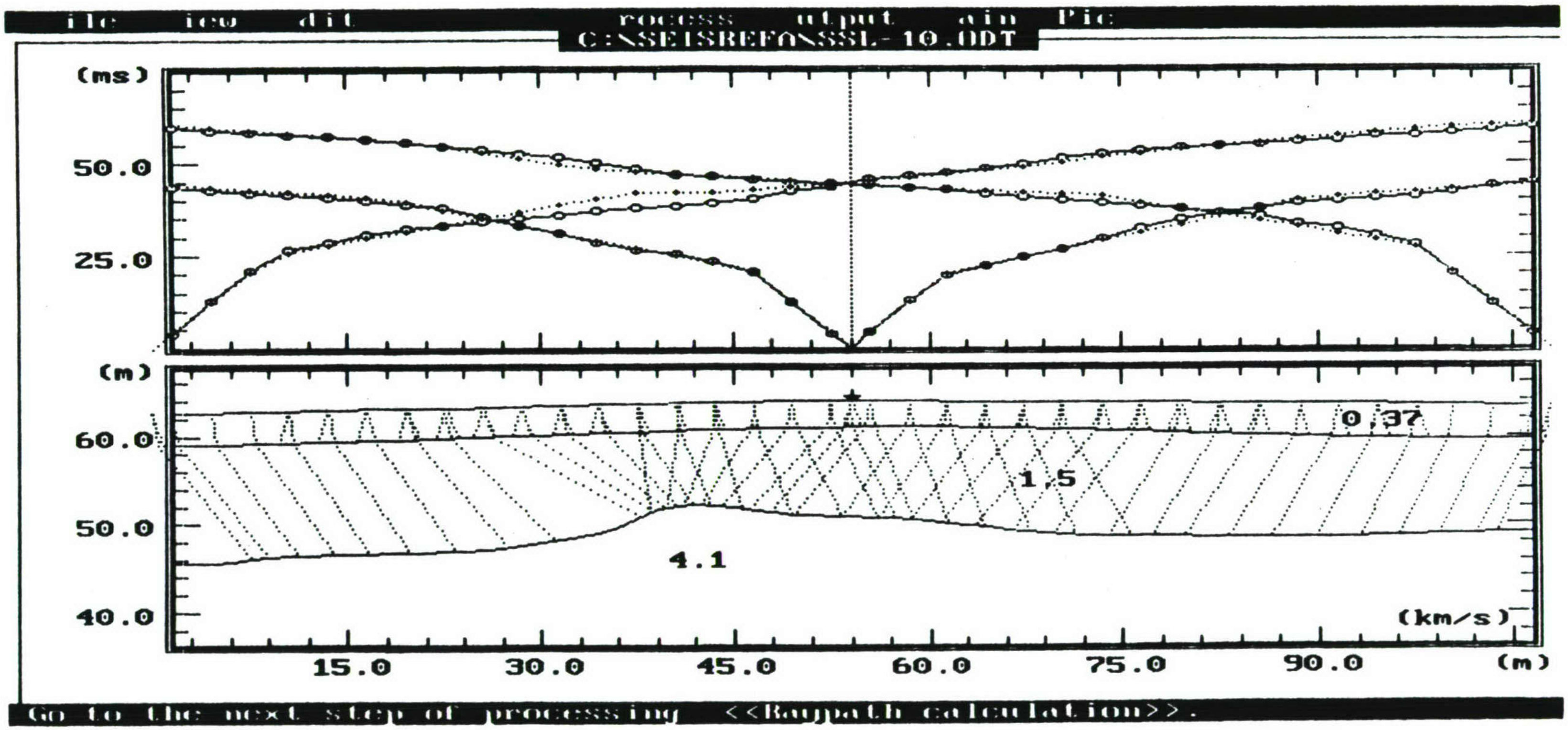


P36/P37 STUDY AREA - SEISMIC LINE SSL-9

SSL-10

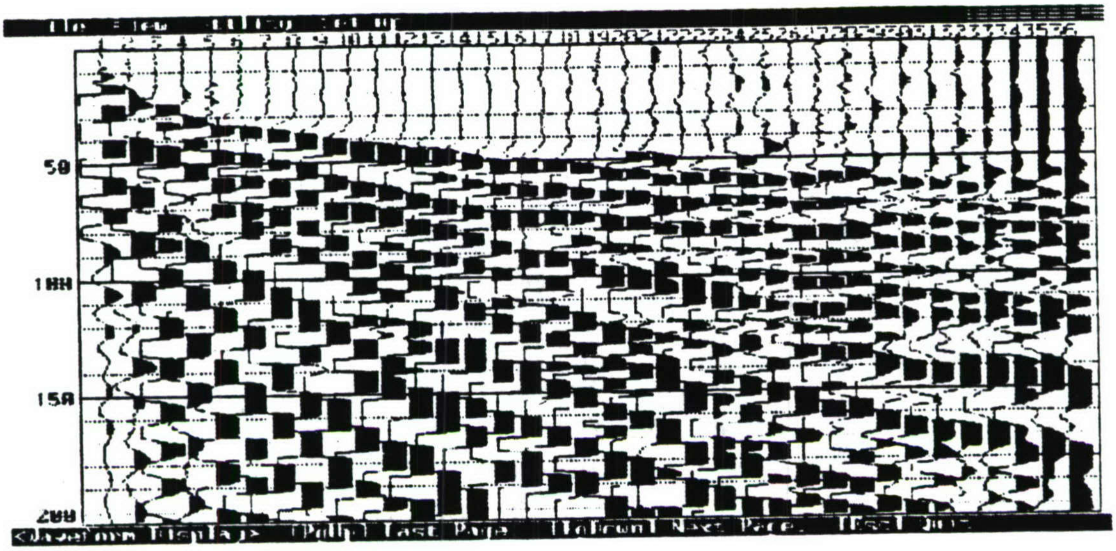


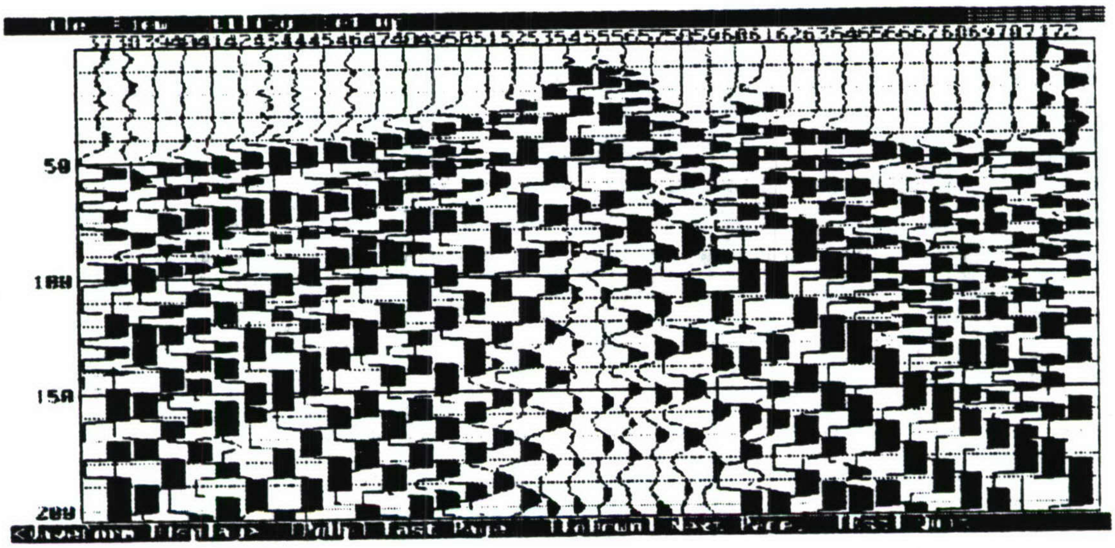
P36/P37 STUDY AREA – SEISMIC LINE SSL-10

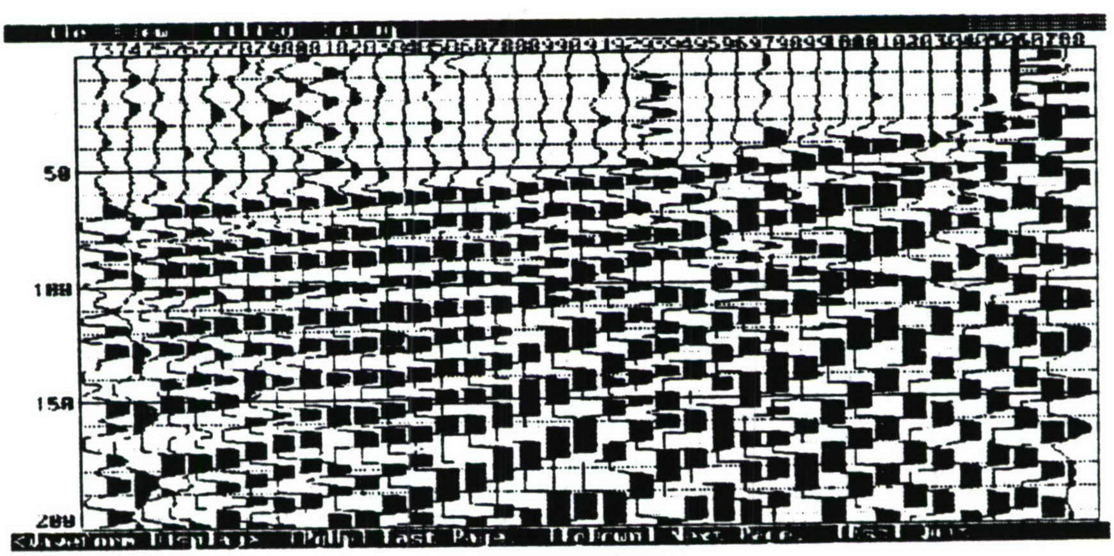


P36/P37 STUDY AREA - SEISMIC LINE SSL-10

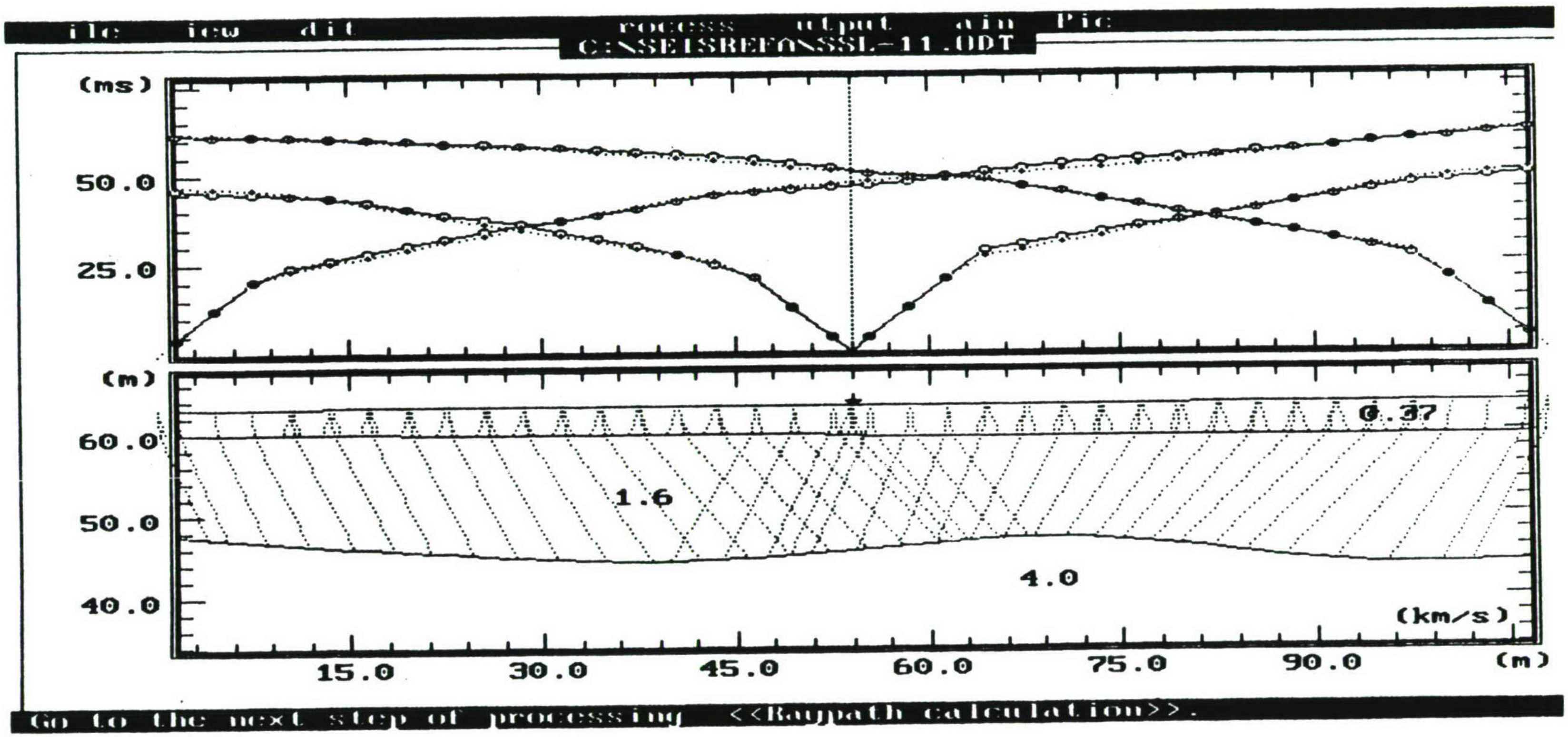
SSL-11





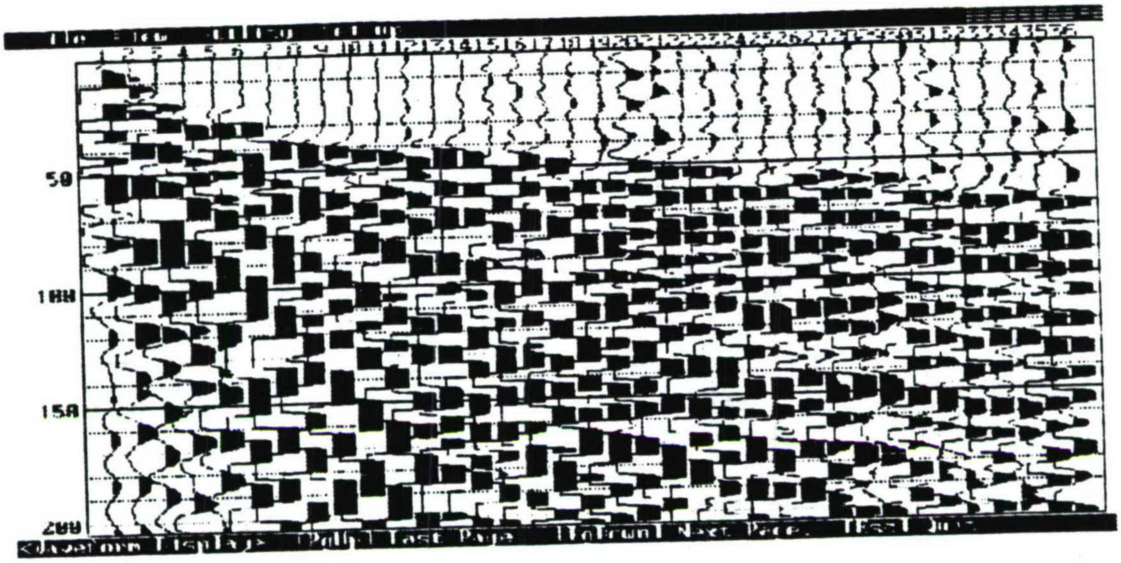


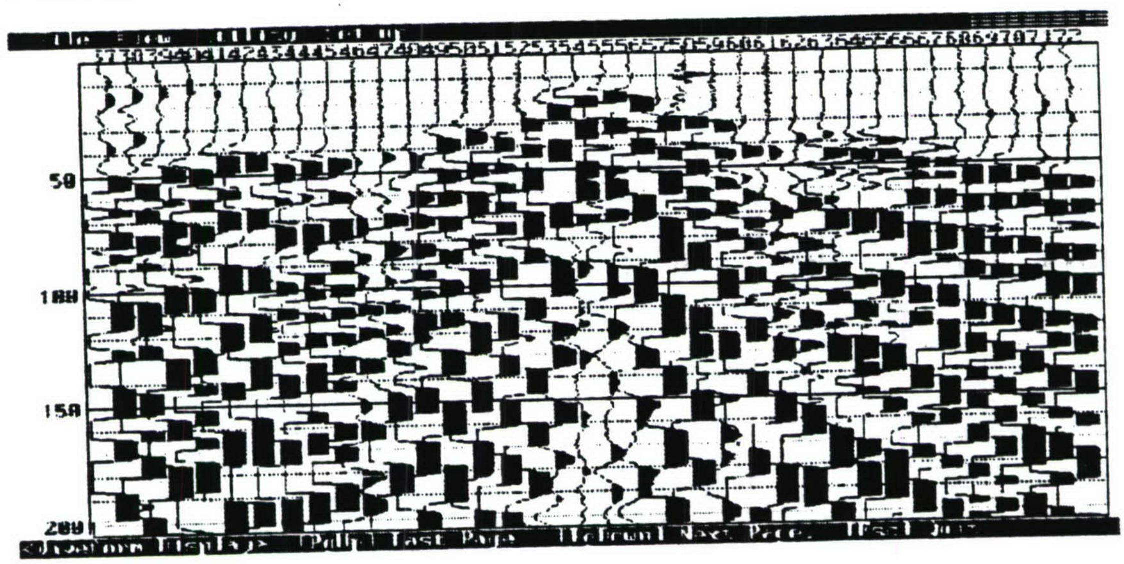
P36/P37 STUDY AREA - SEISMIC LINE SSL-11

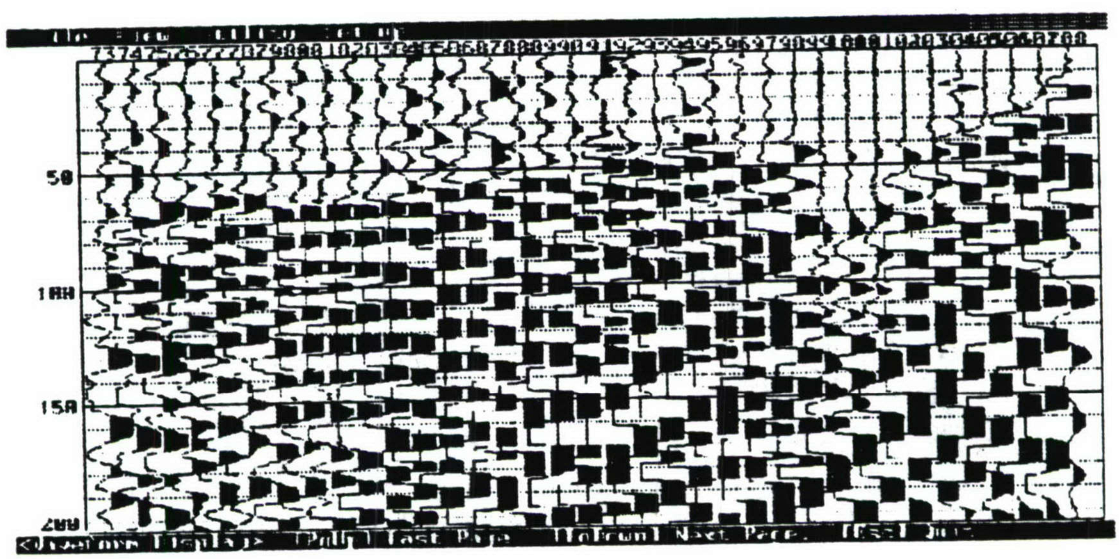


P36/P37 STUDY AREA - SEISMIC LINE SSL-11

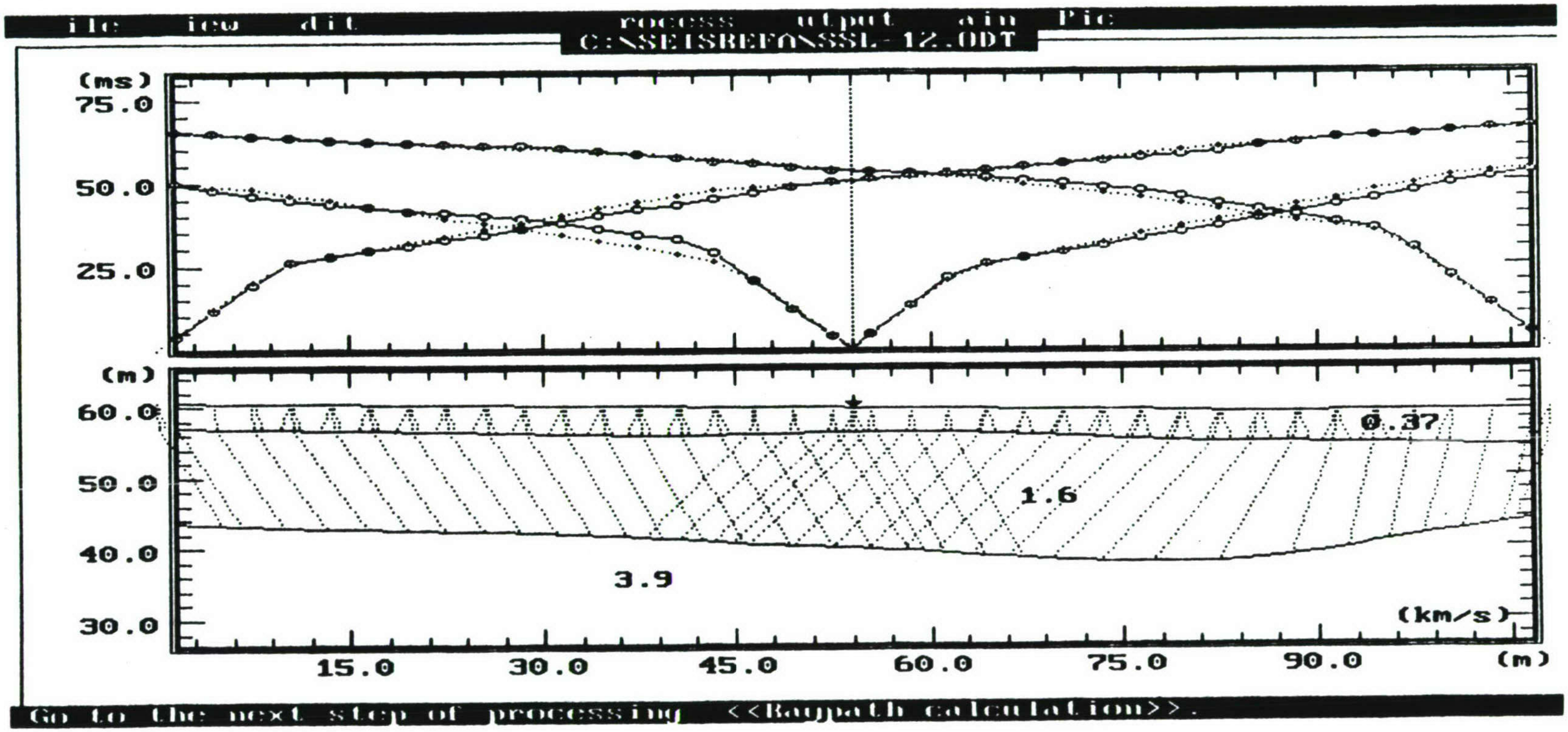
SSL-12





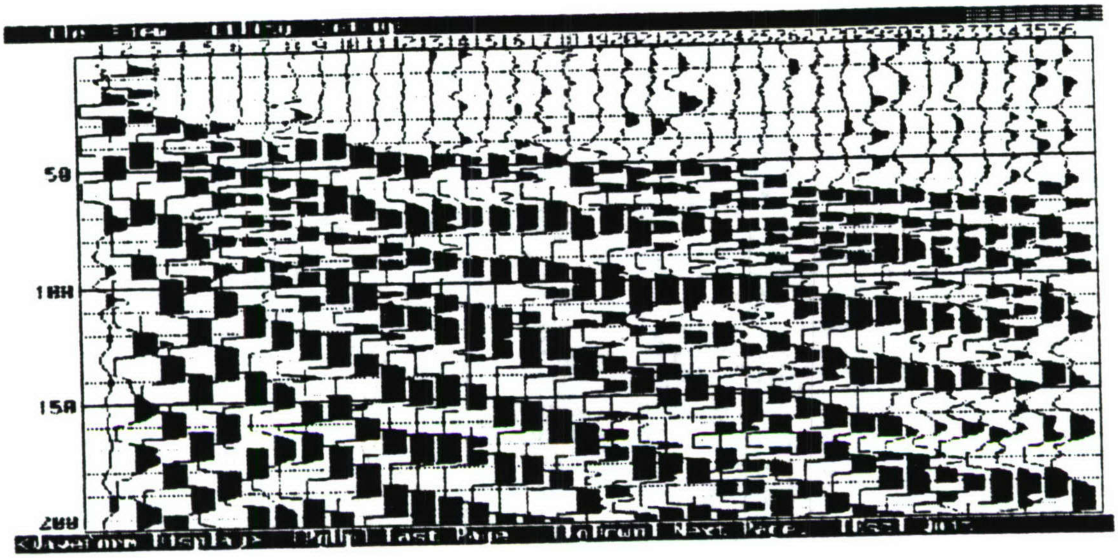


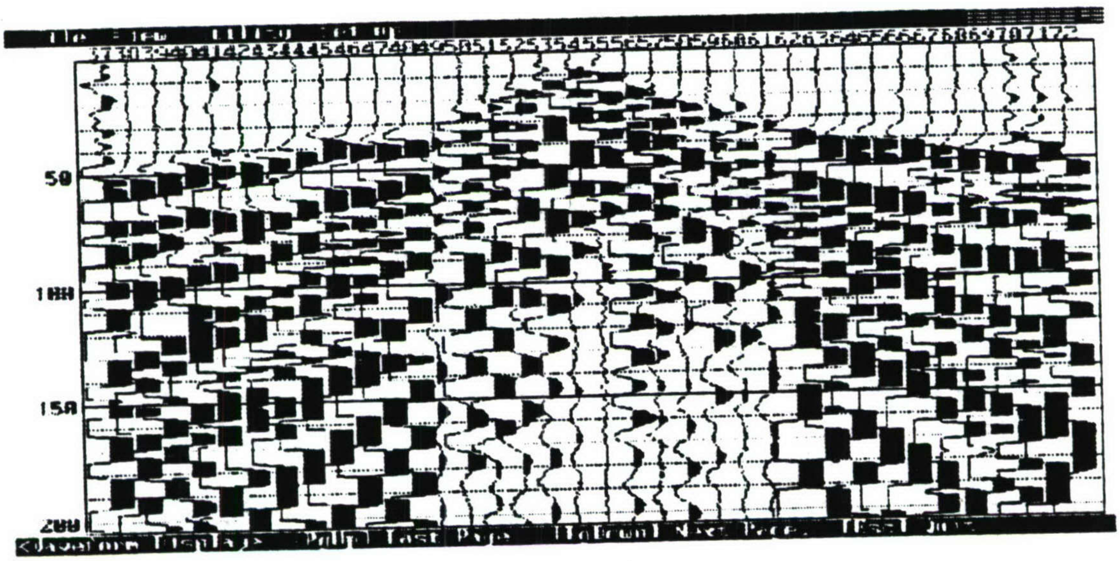
P36/P37 STUDY AREA - SEISMIC LINE SSL-12

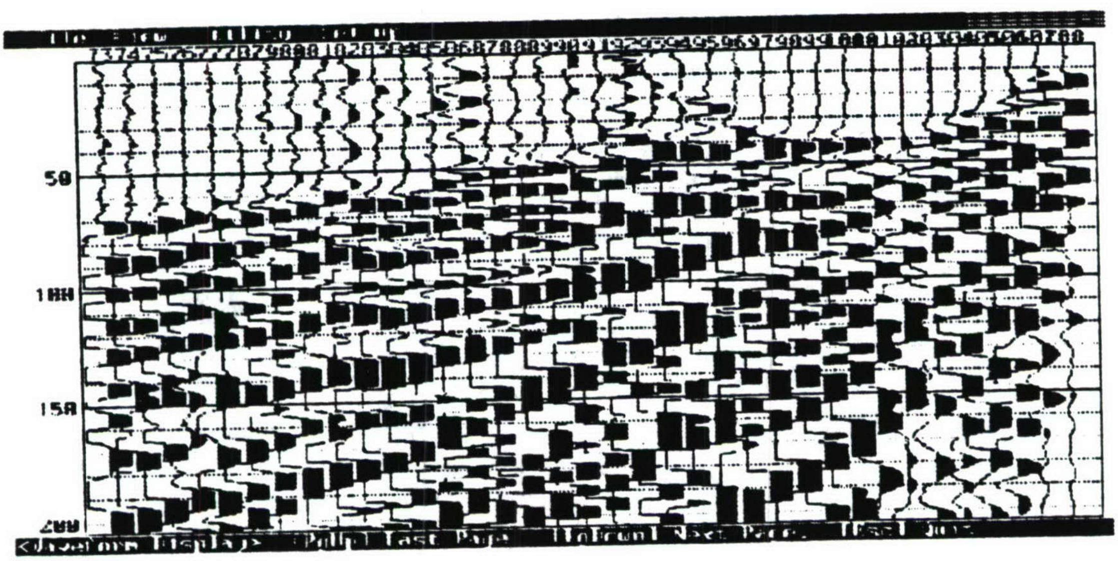


P36/P37 STUDY AREA – SEISMIC LINE SSL–12

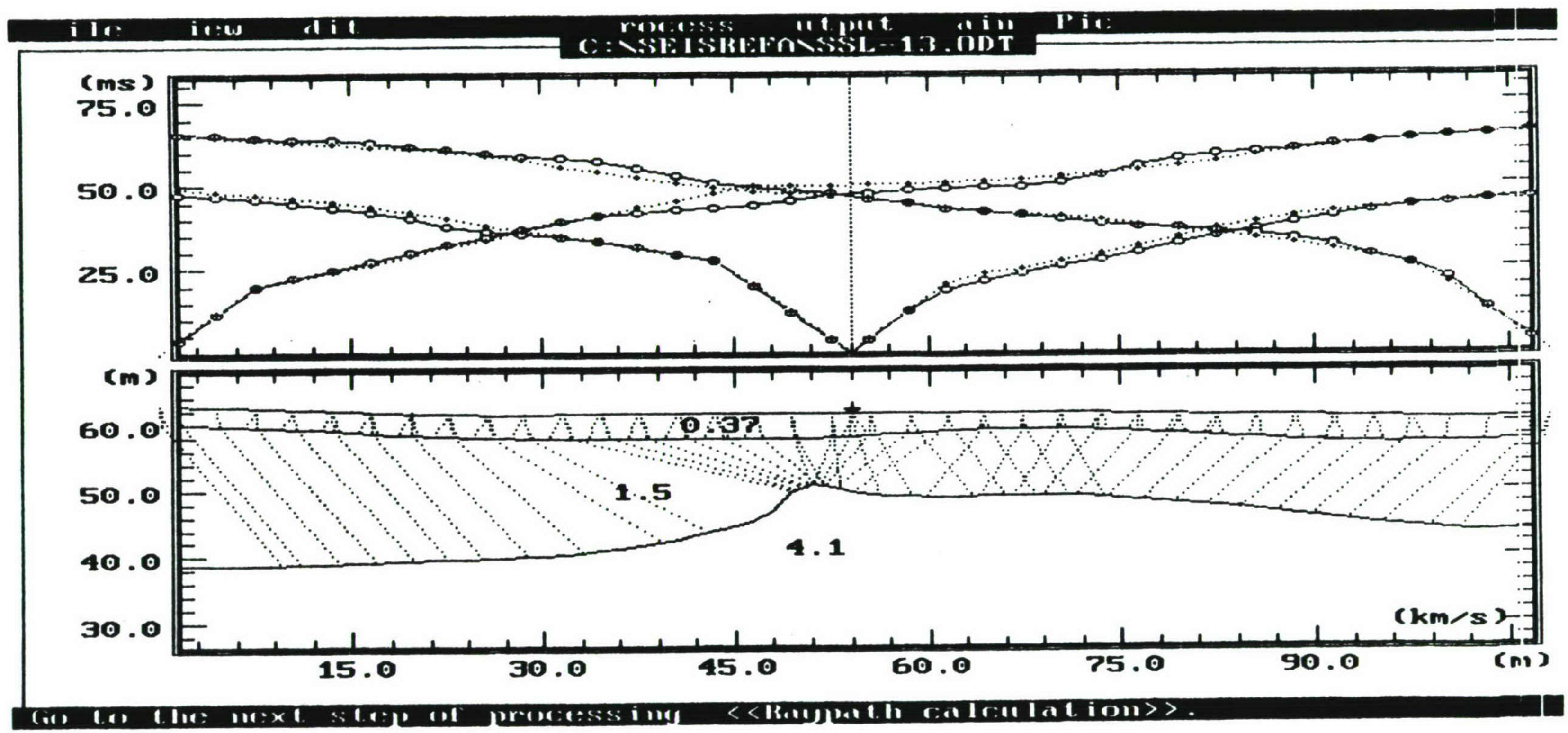
SSL-13





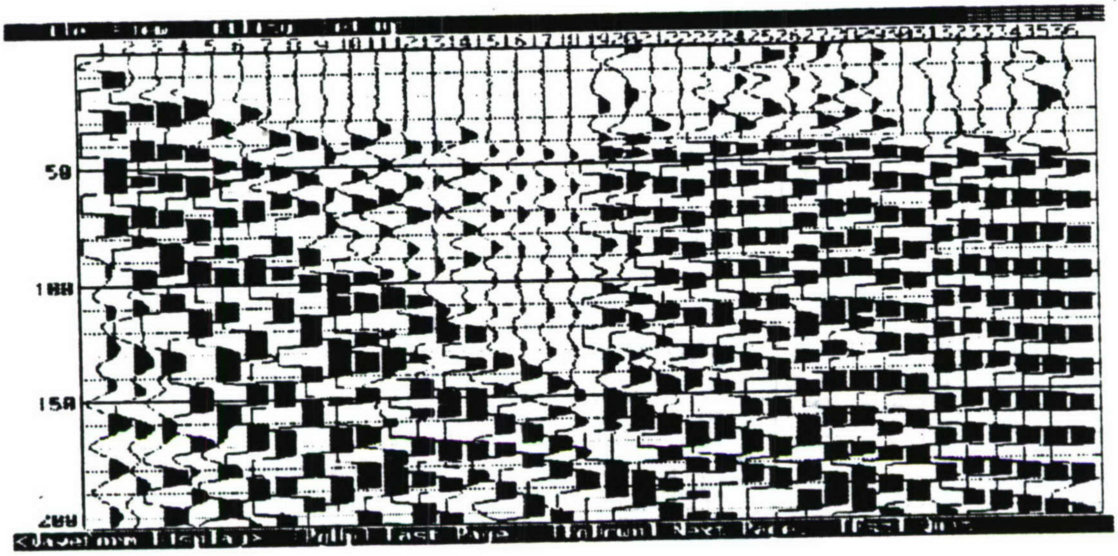


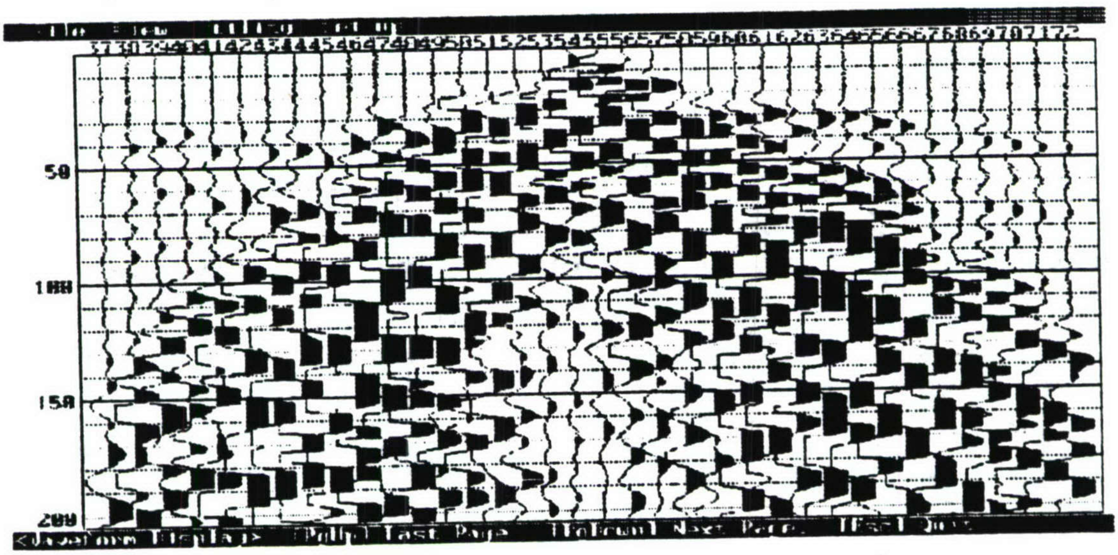
P36/P37 STUDY AREA – SEISMIC LINE SSL-13

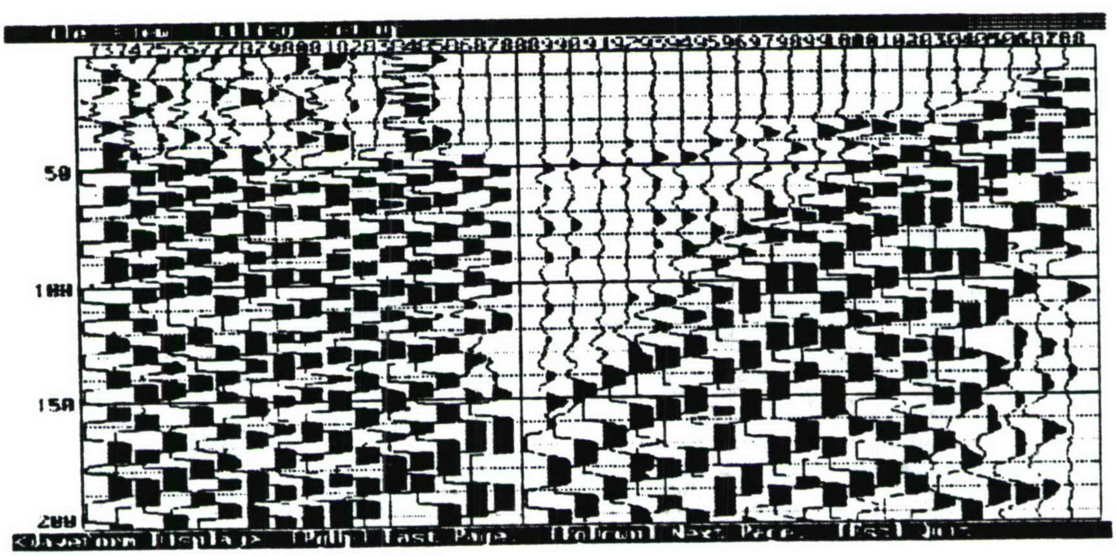


P36/P37 STUDY AREA - SEISMIC LINE SSL-13

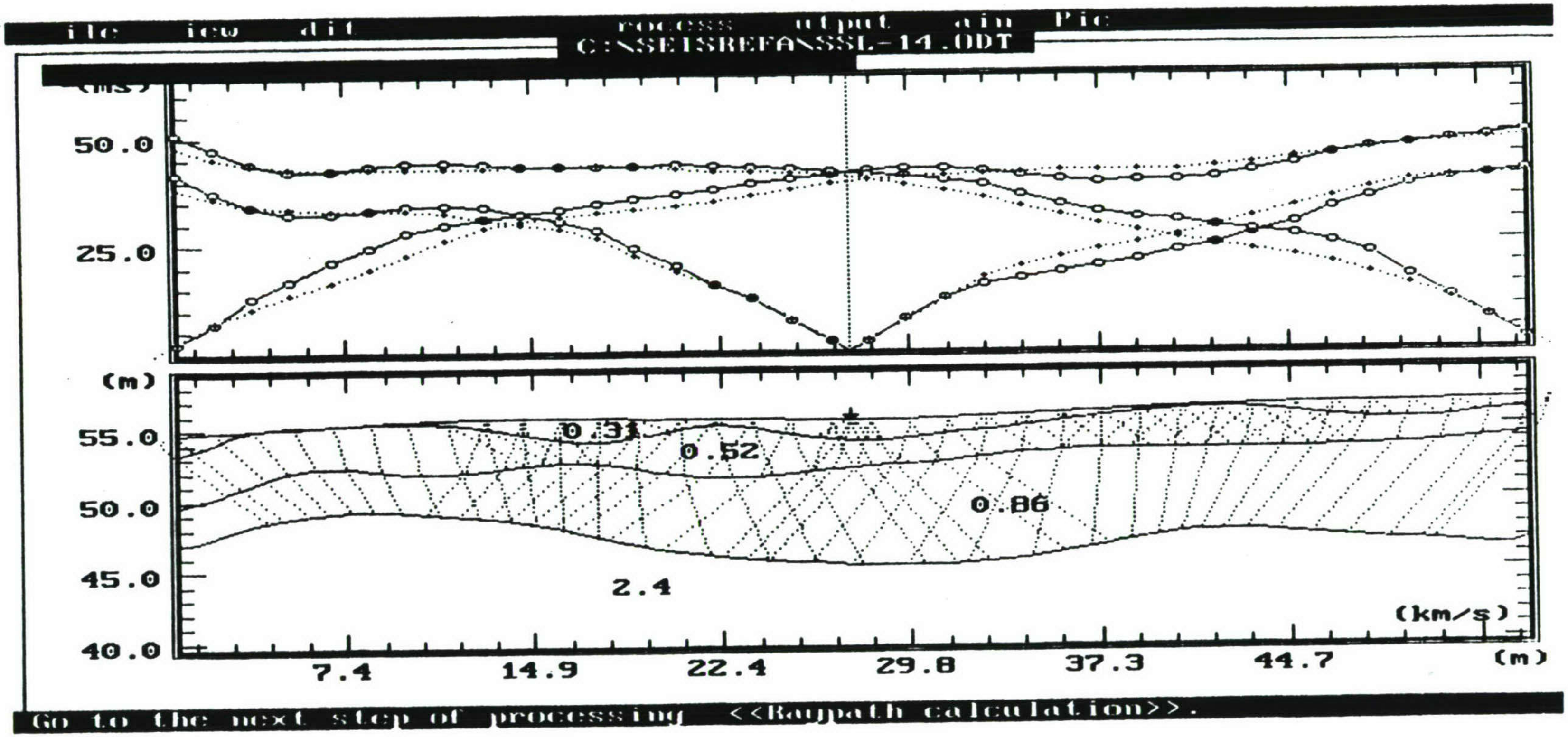
SSL-14





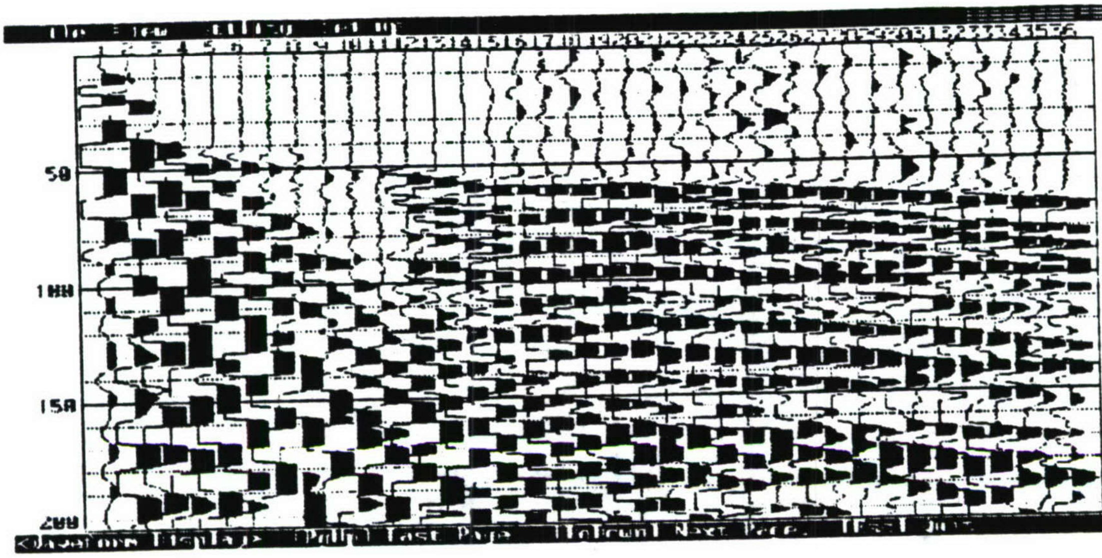


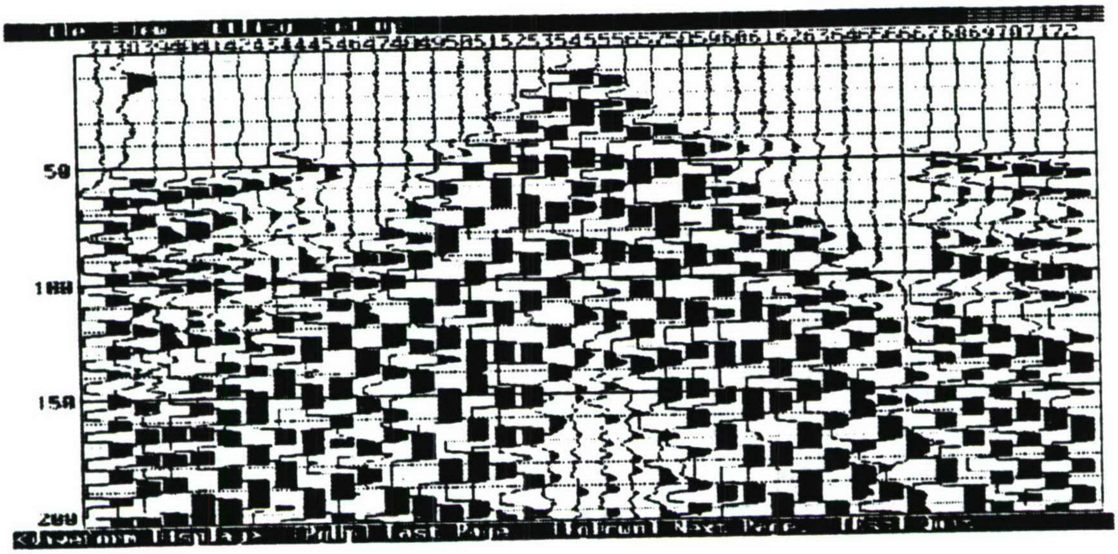
P36/P37 STUDY AREA - SEISMIC LINE SSL-14

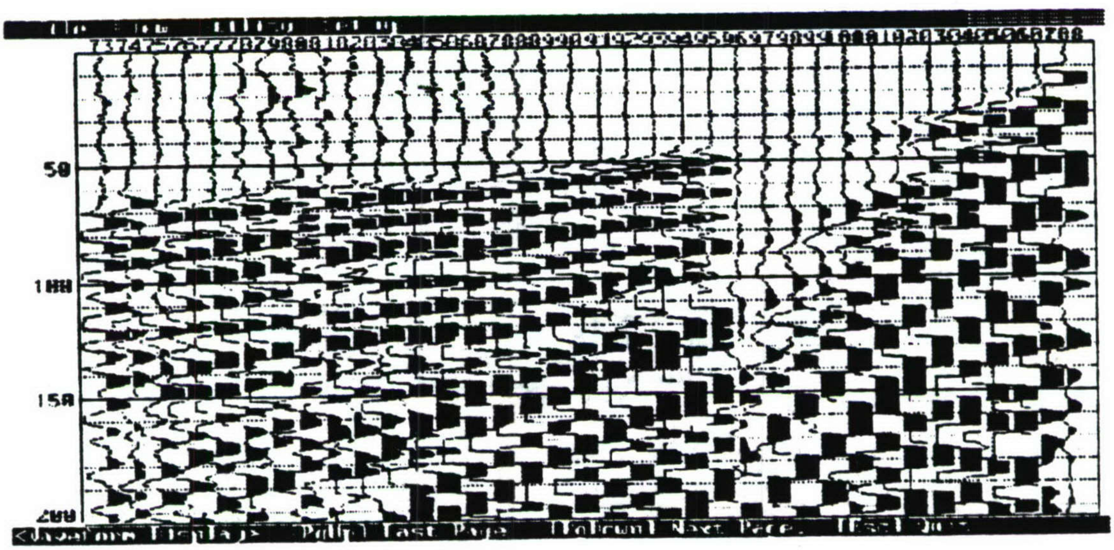


P36/P37 STUDY AREA - SEISMIC LINE SSL-14

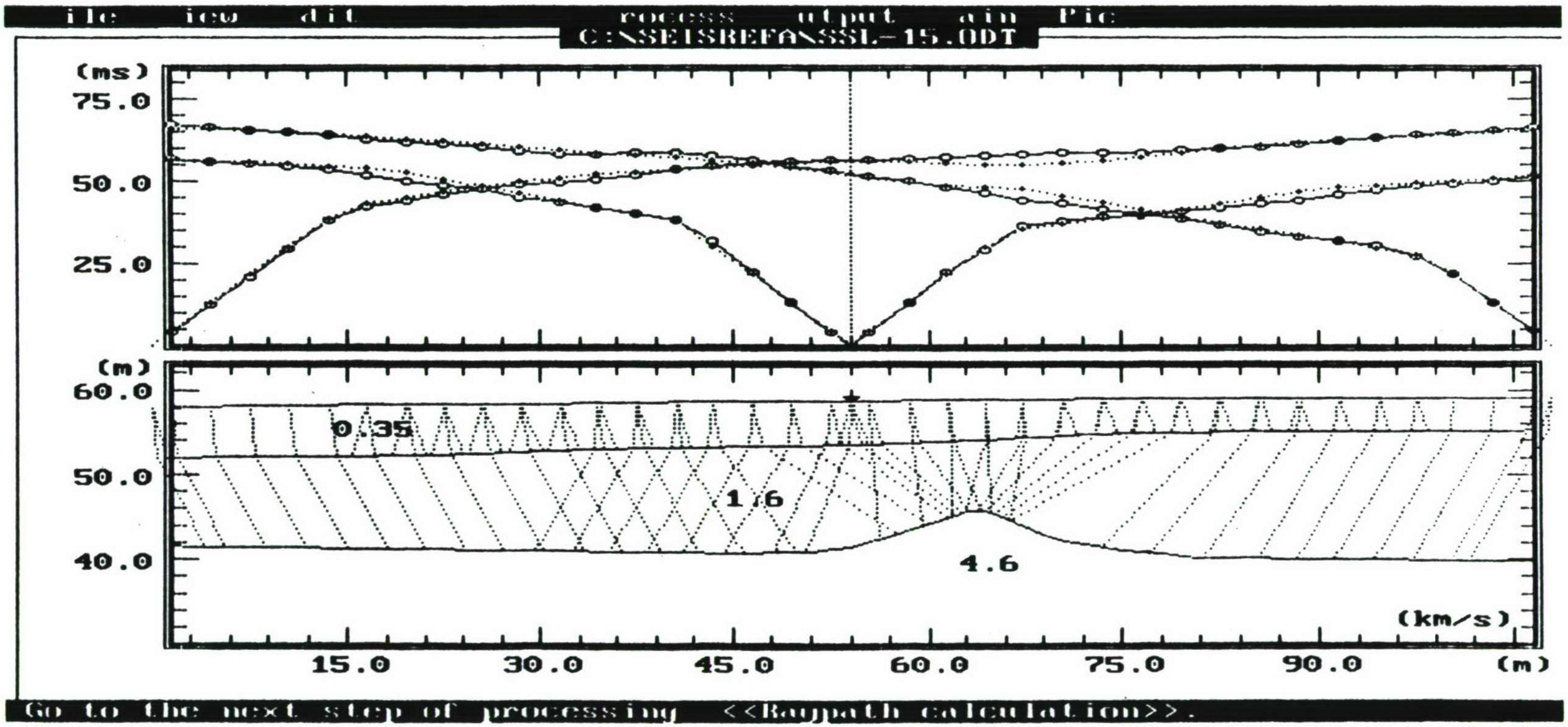
SSL-15





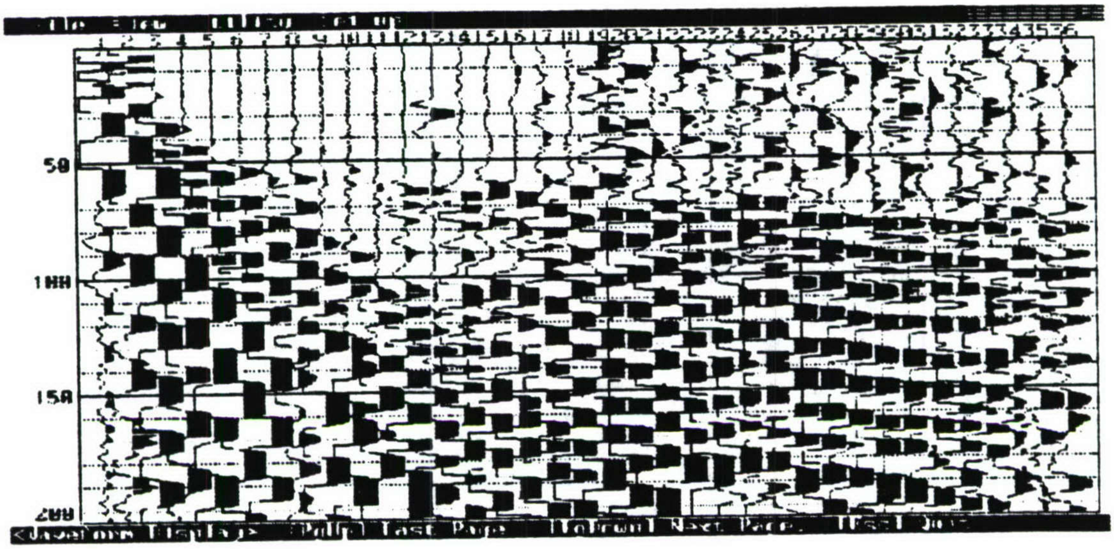


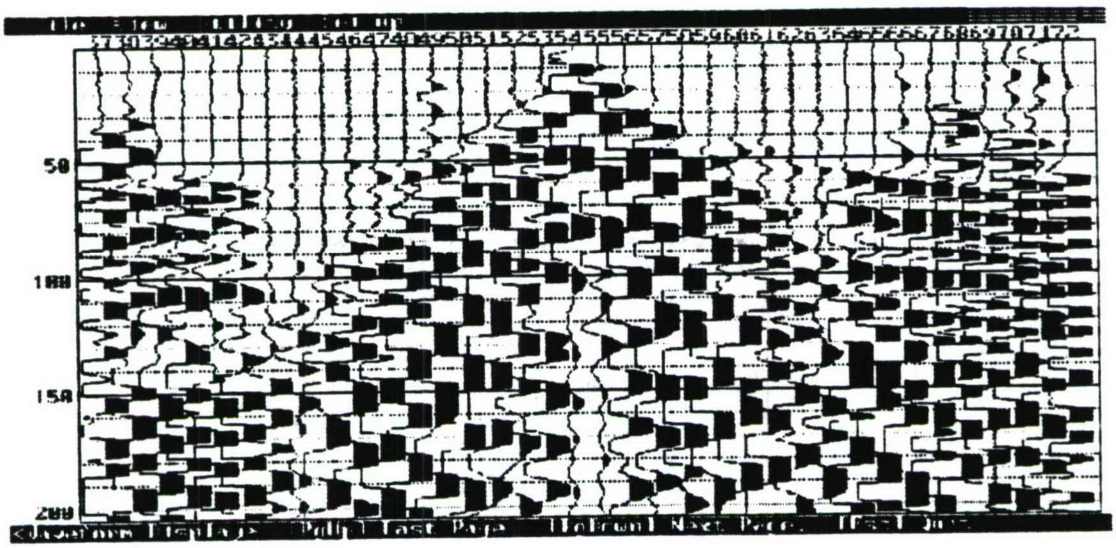
P36/P37 STUDY AREA - SEISMIC LINE SSL-15

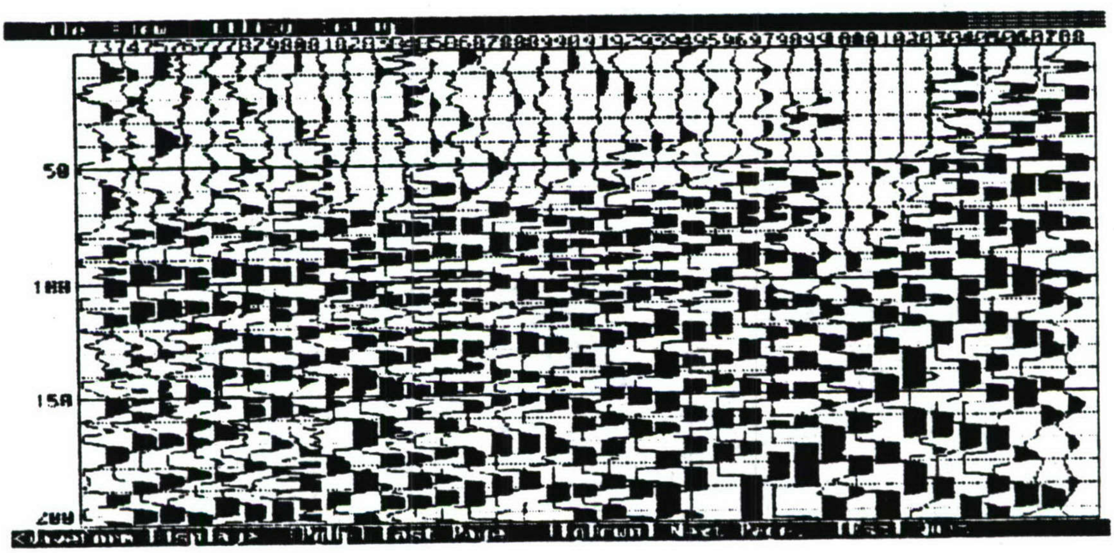


P36/P37 STUDY AREA - SEISMIC LINE SSL-15

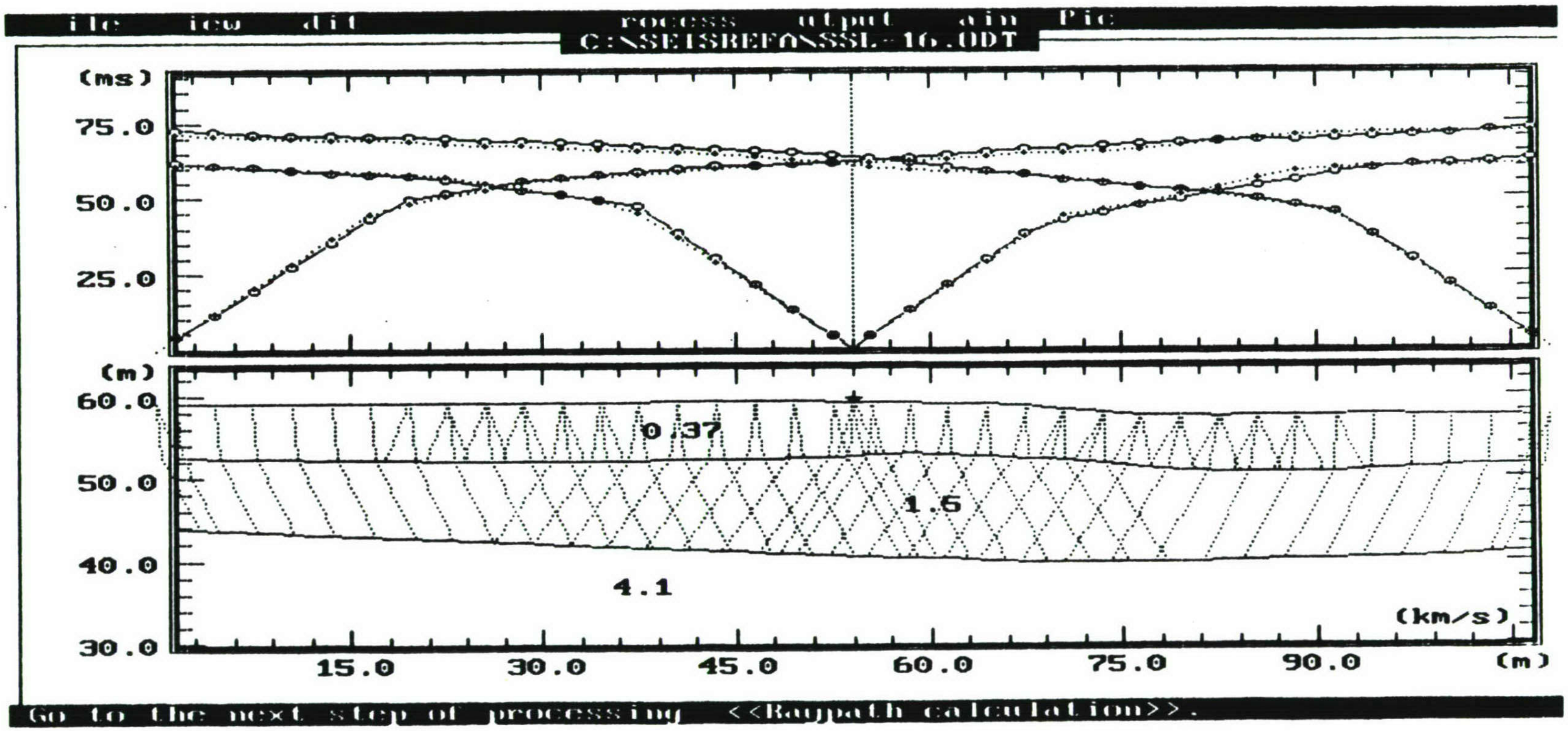
SSL-16





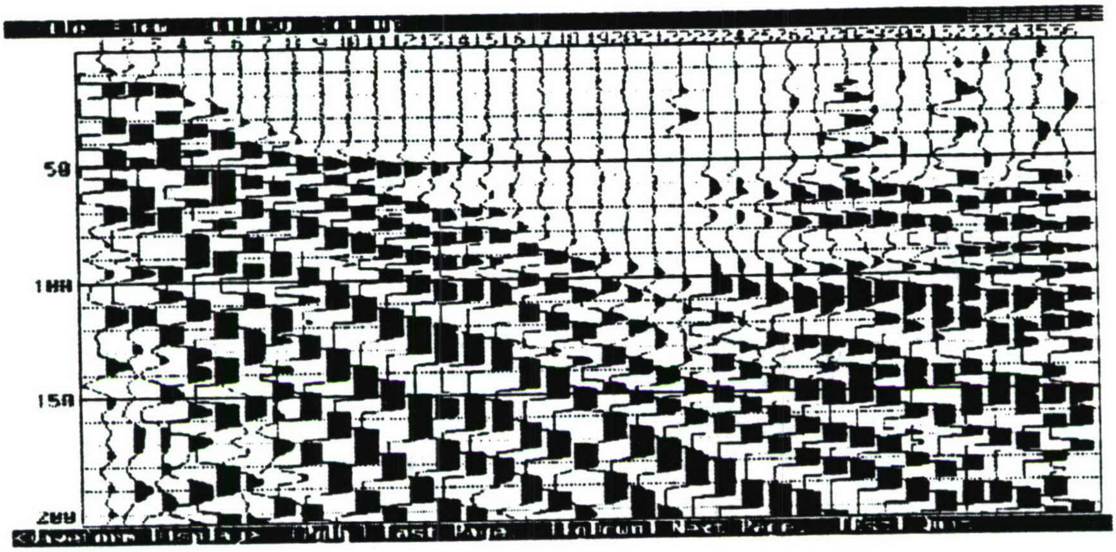


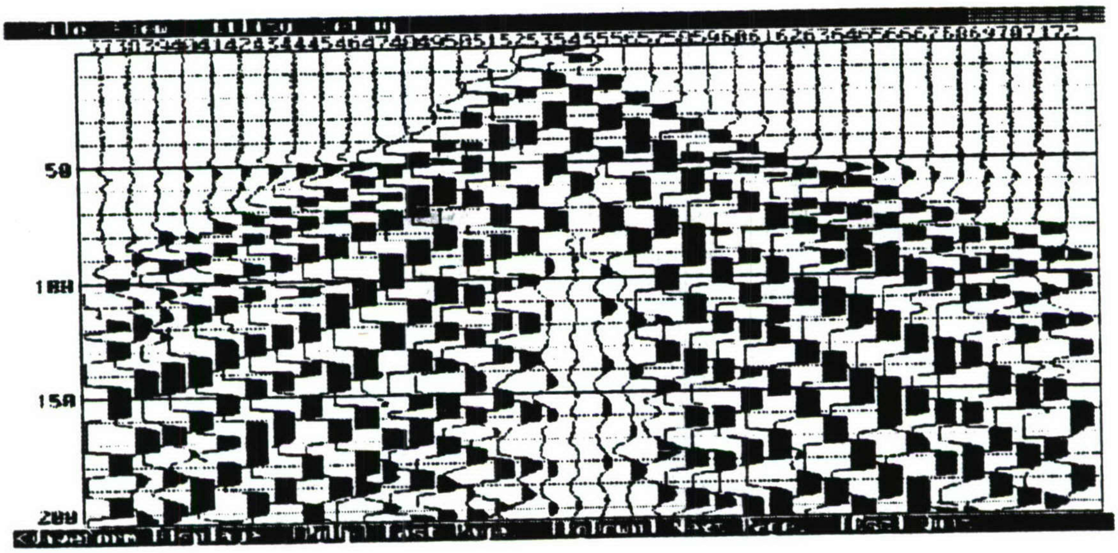
P36/P37 STUDY AREA – SEISMIC LINE SSL-16

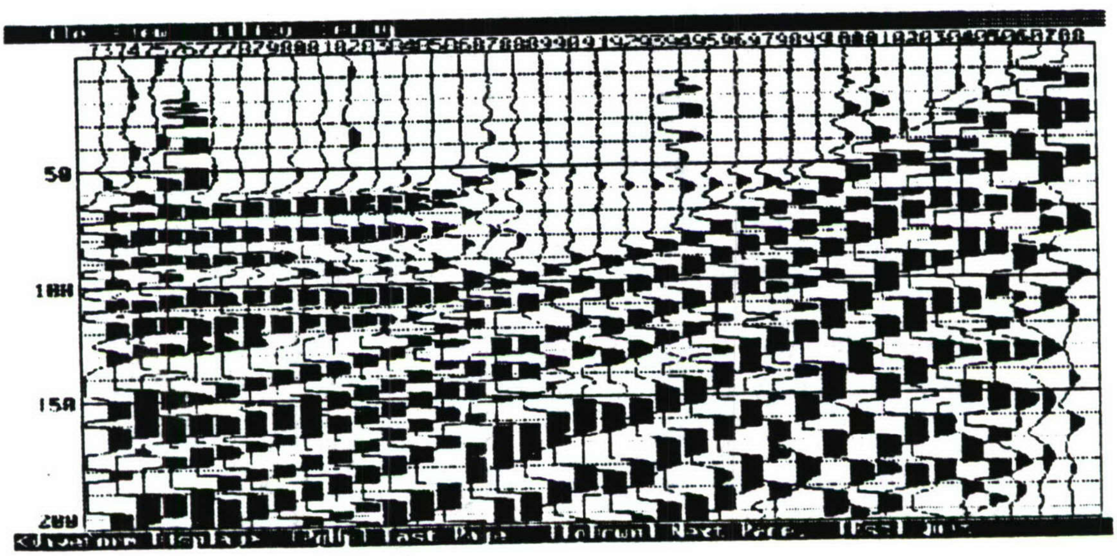


P36/P37 STUDY AREA - SEISMIC LINE SSL-16

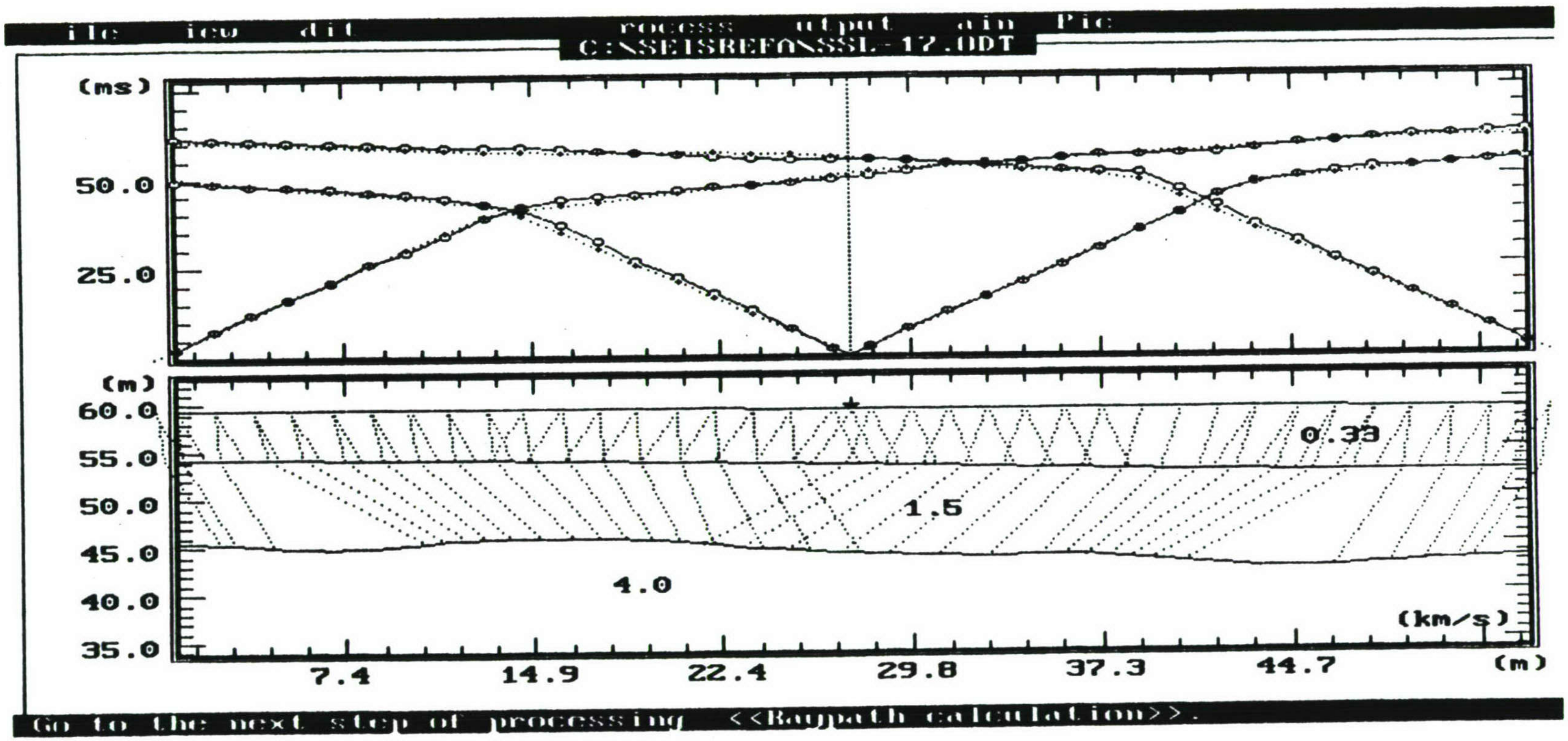
SSL-17







P36/P37 STUDY AREA - SEISMIC LINE SSL-17



P36/P37 STUDY AREA – SEISMIC LINE SSL-17

F

APPENDIX F

ANALYSIS OF QA/QC PROGRAM

APPENDIX F

QA/QC ANALYSIS OF LABORATORY DATA

F.1 INTRODUCTION

This appendix provides an overview of all field and laboratory quality control (QC) samples collected during field investigations at the Sudbury Training Annex of Fort Devens, Massachusetts. The QC sample results were downloaded from USAEC's IRDMIS into E & E's Site Master Database and incorporated into data summary tables presented in this appendix. In some cases, these summary tables include results for both the SI and RI samples to provide complete overview of the potential QC issues.

Data presented here were generated by ESE Laboratories, DataChem Laboratories, and E & E's ASC from the analyses of soil and water samples collected from August of 1993 through January of 1994. The QC sample results were reviewed and assigned with data usability qualifiers as described in Volume I, Section 3.3.3. Each investigation site in Volumes II and III contains a section which provides details of the impact of the QC sample results on the completeness and usability of the data for determining the extent of contamination.

Analyses performed included TAL metals, TCL VOCs, TCL BNAs, TCL pesticides/PCBs, TPHC, explosives, herbicides, organophosphorus pesticides, anions (water only), and TOC (soil only). A summary of methods and recommended method detection limits (RMDL) used by E & E and DataChem, as well as the certified reporting limits (CRL) used by ESE is provided in Table F-1.

The CRL used by ESE defines the lowest concentration of analyte in the sample which can be quantitatively differentiated from zero, with 95 percent confidence, using a complete and specific analytical method for which precision and accuracy criteria are valid. The RMDL used by E & E's ASC and DataChem is based on the method detection limit (MDL), a statistically determined detection limit which defines the lowest concentration detectable for a particular analyte. The MDL is determined by seven consecutive analyses for a given analyte after which the variation in the sample result, a measure of random error in the analyses, at a 95 percent level of confidence, is determined. The value of the t-statistic is then multiplied by the standard deviation of the seven individual measurements to find the lowest concentration that can be differentiated from random error (instrumental interference). The RMDL is chosen to be greater than the MDL for all parameters at a consistent value equivalent to the lowest calibration standard.

F.2 METHOD BLANKS

The analysis of standard matrix method blanks for each analytical lot provides information concerning the possible introduction of laboratory contaminants to the environmental samples. Method blanks consist of a standard matrix that are processed in the same manner as the environmental samples. The standard matrix for soil was provided to the individual laboratories by the USAEC Chemistry Branch and the standard matrix for water was produced by the laboratories according to USAEC guidelines.

Method blanks were analyzed for all parameters within the following analytical tests: TAL metals, TCL VOCs, TCL BNAs, TCL pesticides/PCBs, TPHC, explosives, herbicides, organophosphorus pesticides, anions (water only), and TOC (soil only). Table F-2 provides a listing of the method blanks for each lot in which specific analytes were found. For common laboratory contaminants, sample results less than ten times the blank levels were qualified with a "B". If the compound in the blank was not a common laboratory contaminant, sample results less than five times the blank levels were qualified with a "B". In both cases, the "B" qualifier indicates the sample result is attributable to field or laboratory contamination. If sample results were close to the blank levels, the result was qualified with a "K" as biased high.

F.2.1 TAL Metals

Soil method blank results for TAL Metals were not used to qualify data with regard to laboratory contamination because the USAEC Repository Standard Soil had low levels of metals that do not correspond to the native soils surrounding Sudbury Annex. Thus, it was unusable as a background standard and could not be used to determine whether metals found in field samples were from the standard soil matrix or from processing of the samples.

The only metals found in the water method blanks that affected sample data were potassium, sodium, zinc, aluminum, beryllium, and lead. Of these, potassium and sodium can be attributed to the standard water matrix. However, beryllium, zinc, lead and aluminum would not be expected to be in the standard water matrix and are probably attributable to laboratory contamination from analysis reagents or processing of the samples. Beryllium was detected at trace concentrations in only one of the method blanks and lead was detected at trace concentrations in only two method blanks. These findings did not affect the usability of the data since the metals found in the samples were at much higher concentrations. Conversely, aluminum and zinc concentrations found in the method blanks did compare with concentrations found in samples. In all cases, the samples were qualified with either a "K" or "B" as described above.

F.2.2 TCL Volatile Organic Compounds

The following VOCs were detected in the soil method blanks for the Annex: acetone, methylene chloride, toluene, and 2-butanone. These compounds are common laboratory contaminants and their presence is attributable to the laboratory environment. The affected

data were qualified with either a "K" or "B" as described above. Xylenes were also detected in one blank, but not in any samples.

In addition to methylene chloride and acetone, the TCL VOCs found in the water method blanks were chloroethane, chloroform, and carbon disulfide. Although none of these compounds are considered to be laboratory contaminants, their presence is attributable to the laboratory background or artifacts from the preservation of samples. The associated sample data were qualified as described above, but the compounds were generally not found in the samples.

F.2.3 TCL Base Neutral Acid Extractables

The TCL BNAs and tentatively identified compounds (TICs) that were routinely detected in the method blanks are *bis*(2-ethylhexyl)phthalate, butyl benzyl phthalate, diethyl phthalate, and di-*n*-butyl-phthalate. Phthalates are associated with plastic products and can therefore be attributed to laboratory and field contamination. The remaining compounds (C35, C36, and Linola) are TICs and are estimated quantitatively. Most likely these are artifacts from laboratory procedures. For all cases, with the exception of the TICs where parameter concentrations in the method blanks compared to the sample concentrations, the sample data were qualified with a "B" as described in Section 3.3.3.

Other TCL BNAs were detected in a single method blank. The results appear to be attributable to laboratory background or glassware carryover and did not affect sample results.

F.2.4 TCL Pesticides/PCBs

TCL pesticides which were detected in the soil method blanks include: alpha-BHC, alpha-chlordane, alpha-endosulfan, aldrin, beta-endosulfan, delta-BHC, dieldrin, endrin, endrin aldehyde, endosulfan sulfate, gamma-chlordane, heptachlor, heptachlor epoxide, lindane, DDD, DDE, and, DDT. Affected data were qualified as described in Volume I, Section 3.3.3.

There were no confirmed detections of pesticides in any of the water method blanks. Several compounds present at trace concentrations due to laboratory background, co-eluted with pesticides on the primary column, but these compounds were not detected on a secondary column. As a result, no data were qualified based on the water method blanks for these compounds.

There were no TCL PCBs detected above the MDL in any of the soil or water method blanks.

F.2.5 Total Petroleum Hydrocarbons

TPHC was not found in either the soil or water method blanks.

F.2.6 Explosives

There were no explosives detected above the MDL in any of the soil method blanks.

The only explosive above the RMDL in the water method blanks was 4-amino-2,6-dinitrotoluene and results were qualified accordingly.

Several nitrotoluene compounds were detected and initially reported as estimated values below the RMDL in both the method blanks and samples. A QA/QC review of the explosives data indicated that the nitrotoluene compounds could not be accurately identified or quantified below the RMDL. Therefore, all explosives below the RMDL that were not confirmed on a second column were reported as less than the RMDL and were not used for evaluating contamination. Cyclonite was also detected in the water method blank below the RMDL for only one explosives lot. Since Cyclonite was only found in samples within this lot below the RMDL, no data were qualified. Overall, because Cyclonite was detected in many blanks and samples at concentrations below the RMDL, the results were judged to be too low and undifferentiable from background interference. Consequently, all unconfirmed sample data for Cyclonite with results below the RMDL were reported as less than the RMDL.

F.2.7 Total Organic Carbon

There was no carbon found in any of the TOC method blanks.

F.3 RINSATE BLANKS

Rinsate blanks are field QC samples that are used to provide information on the potential for sample contamination from disposable field equipment or from carryover from ineffective decontamination of reusable equipment. Rinsate blanks are collected by flushing analyte-free water over the sampling equipment into sample bottles and then preserving the rinsate blank sample as a normal sample. The "analyte-free" water used was obtained through Fisher Scientific or VWR Scientific as deionized, ultra-filtered reagent water. These samples are then analyzed for the same parameters as the samples for the associated area.

Rinsate blank samples were assigned for each matrix. The types of equipment for which rinsate samples were collected were: teflon bailers which were used for groundwater samples, stainless-steel split spoons used for subsurface soil sampling from borings, disposable aluminum pans sometimes used for surface soil and sediment sampling, and the backhoe shovel which was used for most of the excavation samples. The analytes which were found in the rinsate blanks collected at the Annex are listed in Table F-3 and can be differentiated by a "R" in the second character of the field sample number. If sample results were not previously qualified from method blank contamination, the samples associated with rinsates were qualified as described in Volume I, Section 3.3.3.

F.3.1 Soil Samples Rinsates

Soil rinsates were broken into two groups: surface soil/sediment and excavation/subsurface soils, based on sampling technique and equipment used.

F.3.1.1 Surface Soil/Sediment Rinsates

There were four rinsate samples collected (DR2601X1, DRBCK021, DRPUF011, and DRP13012) for the sediment samples collected at the Sudbury Training Annex. The only analytes found in these rinsate blanks were: antimony, cadmium, potassium, zinc, 1,1,1-trichloroethane, acetone, methylene chloride, di-*n*-butyl-phthalate, carbon disulfide, and chloroform. All of the metals found were detected at trace levels below their respective RMDL and qualified as estimated. The volatile organics were all considered to be due to laboratory contamination or were found at trace levels below their RMDL. Heptachlor was detected but was unconfirmed by a second column and was qualified as unconfirmed and flagged with a "U". Di-*n*-butyl-phthalate was also considered due to field or laboratory contamination due to plasticizers. The presence of the trace level of cadmium and zinc were most likely caused by interelement interferences on the ICP instrument. The presence of antimony was probably a laboratory artifact and potassium was attributed to the "analyte-free" water used to collect the rinsate.

There was one rinsate blank sample collected (SR4201X1) for the surface soil samples collected at the Sudbury Training Annex. Surface soil samples were collected by homogenizing the samples in the ground or in disposable aluminum pans with disposable stainless steel spoons. The analytes detected in the rinsate sample were sodium, potassium, acetone, methylene chloride, and di-*n*-butyl-phthalate. The presence of potassium and sodium was attributed to the "analyte-free" water used to collect the rinsate sample and were both found below the RMDL. The volatile organics and di-*n*-butyl-phthalate were most likely a result of laboratory contamination.

F.3.1.2 Excavations/Subsurface Soil Samples Rinsates

There were four rinsate blank samples collected for excavation samples collected at the Annex (ERA08011, ERA11011, ERP31011, and ERP56011). Analytes found in these samples included 2,4,5-T, aluminum, methylene chloride, chloroform, carbon disulfide, di-*n*-butyl phthalate, iron, heptachlor, heptachlor epoxide, total phosphorus, and zinc. The pesticide results were not confirmed and these detections along with other compounds are attributable to laboratory background. However, the only analytes which were found to affect sample data above the method blank concentrations were acetone and zinc.

There were nine rinsate samples collected to provide field QC for the subsurface soil samples collected at the Annex. The following parameters were detected in these rinsates samples: aluminum, sodium, zinc, potassium, iron, manganese, arsenic, lead, copper, methylene chloride, acetone, bis-2-ethylhexyl phthalate, di-*n*-butyl phthalate, 1,1,1-trichloroethane, and the TICs Hedoda and Linola. The presence of the methylene chloride,

acetone, and the phthalates were all considered present due to laboratory contamination. Linola and 1,1,1-trichloroethane were both found to be present due to laboratory contamination or the source water and were qualified with a "B". Most of the metals found were considered due to the blank or were found at trace levels below the RMDL. The only exceptions were iron at 410 μg/L in BRP01042 and at 87 μg/L in BR3701X1, aluminum at 45 μg/L BR0201X1 and arsenic and lead at 2.67 μg/L and 17.2 μg/L, respectively, in BR3801X1. Of these only arsenic and lead were unexpected, and only the data for lead for BX380101 and BX380101 were qualified as present due to the blank.

F.3.2 Water Samples Rinsates

Rinsate blank samples for the water matrix were only collected for groundwater samples. Filtered and unfiltered samples were collected to adequately monitor the two sample types.

F.3.2.1 Unfiltered Rinsates

Six unfiltered rinsate samples were collected at the Annex. Analytes found in the analytical results of the rinsate samples included 1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-dinitrotoluene, acetone, silver, methylene chloride, chloroform, carbon disulfide, di-*n*-butyl phthalate, heptachlor, lindane, DDT, and TPHC. Of these only TPHC and heptachlor affected sample data which were appropriately qualified with a "B" to indicate field or laboratory contamination as described in Volume I, Section 3.3.3. It is possible that their presence may be due to carryover from the laboratory apparatus used in the analysis. The other analytes detected were probably due to isolated incidents of laboratory background contamination or the source of analyte-free water, but data were not affected.

F.3.2.2 Filtered Rinsates

There were five filtered rinsate QC samples collected for the 61 filtered samples collected at the Annex representing 8.2 percent of the samples. Only antimony and iron found in one filtered rinsate sample were determined to affect the corresponding sample data. The presence of these metals is probably due to particulate matter smaller than the 0.45 micron pore size filters used or to dissolved metals in the source of analyte-free water. Other analytes found in the rinsate samples which had no effect on sample data were: beryllium at trace concentrations, aluminum, zinc, manganese, calcium, lead, and magnesium. These are all probably attributable to either laboratory contamination or the analyte-free water used.

F.4 TRIP BLANKS

Trip blanks are field QC samples used to monitor volatile organic contamination occurring during shipment of samples. They are samples of deionized ultrafiltered water that have been preserved as a volatile sample to accompany the sample bottles to the sampling location, and then are shipped with the samples to the laboratory. Trip blanks are shipped for

each matrix at a frequency proportional to the number of VOC samples collected. Care is taken so that every sample for TCL VOCs has a trip blank to which it was associated.

A total of fifty-eight trip blank samples were shipped with VOC samples collected at the Annex. VOC samples were packaged in a single cooler and were accompanied by a trip blank for each matrix. Only four analytes were found in the trip blanks: acetone, methylene chloride, carbon disulfide, and 1,1,1-trichloroethane. Only two samples and three QC samples were affected (BX360302, EXP26042, BR3801X1, BR4801X1, and DR2601X1). The first three compounds are common laboratory contaminants and would be expected to be found in samples analyzed for TCL VOCs. Trip blank samples results are presented in Table F-4 and can be differentiated by a "V" in the second character of the field sample number. The presence of 1,1,1-trichloroethane appears to be related to the source of analyte-free water as exhibited by the rinsate data.

F.5 FIELD DUPLICATE SAMPLES

Field duplicate samples are collected, handled, shipped, and analyzed in the same manner and for the same parameters as the sample to which they compare. These samples provide a measure of the precision of the sampling and analysis procedures.

Precision is determined through the calculation of relative percent difference (RPD) between the analytical results of the field duplicate and the normal sample. The RPDs were reviewed to determine which data were outside the RPD control limits set by the EPA Inorganic or Organic Guidelines. For inorganic analyses, the limits are ±30 percent for water samples and ±50 percent for soil samples for sample results greater than 5 times the MDL. For organic analyses, the control limits used are ± 2 times the MDL for water samples and ±4 times the MDL for soil samples. For organic analyses, the control limits used for water samples was ±30 percent for water samples and ±50 percent for soil samples. In circumstances in which these limits were not met, the samples were qualified as estimated.

There are also circumstances in which a RPD value could not be calculated because one sample result was above the RMDL and one sample result was reported below the RMDL. These occurrences have been reviewed on a case by case basis. In samples for which the result is below 2 times the RMDL for water samples or 4 times the RMDL for soils, the result is considered to be comparable to the RMDL and these data were not qualified. For cases in which the detected sample concentration was found above these levels, the data were qualified as estimated because the result is considered to be significantly different than the RMDL.

Field duplicate samples results are found in Table F-5 and are differentiated from the original sample by the letter "D" in the second character of the field sample number.

F.5.1 Soil Duplicate Samples

There were twenty-one field duplicate pairs for soils collected at the Annex to monitor field and analytical technique; four of which were collected for sediment three for subsurface soils, and fourteen for surface soils. At the RI sites, one duplicate pair was collected for sediments at Site P13 and one duplicate pair was collected for subsurface soils at Site P37.

For duplicate pair (BX370302/BD370302), only TOC was found to exceed RPD criteria with a value of 58.2 percent. As a result TOC in these two samples was qualified as estimated. There were two analytes which did not meet precision criteria for duplicate pair DD1301X1/DX1301X1. Copper was qualified as estimated for every sediment sample in the watershed because its RPD was 115.5 percent. Likewise, iron was qualified as estimated for all sediment samples in the watershed because its RPD was 166 percent.

F.5.2 Water Duplicate Samples

Duplicate samples were collected for both surface water and groundwater samples. Furthermore, groundwater duplicate samples were collected for both unfiltered and filtered samples.

F.5.2.1 Unfiltered Duplicates

There were four duplicate samples collected for surface water samples, but only one was collected specifically at the RI sites (Site P11). Three duplicate pairs exhibited at least one analyte which was qualified as estimated because its RPD fell outside of RPD QC criteria. The first such set was (WXP11012/WDP11012) for aluminum (33.7%), barium (39.8%), and iron (41.9%). Each was qualified for all surface water samples within the watershed. The second set was (WXBCK021/WDBCK021) for aluminum (87%), iron (65.5%), and total phosphorus (126.1%). Each of these analytes were qualified as estimated for all surface water sample results, above the RMDL, within the watershed. For duplicate pair (WX2601X1/WD2601X1), only aluminum barely fell outside of RPD criteria and all aluminum results above the RMDL for Watershed 1B were assigned data usability codes of "J".

There were nine unfiltered groundwater duplicate pairs collected at the Annex for the two rounds of groundwater sampling, three of which were located on RI sites. The only analyte for the RI which was qualified from the first round of groundwater sampling was arsenic from duplicate pair MX1101X1/MD1101X1. As a result, all samples from Watershed 1B were qualified as estimated for round one.

In duplicate pair MXP58012/MDP58012, aluminum (148.1%), arsenic (151.3%), barium (33.1%), iron (90.4%), magnesium (95.8%), nickel (107.5%), vanadium (124.9%), zinc (31.1%), and total phosphorus (188.3%) were found to exceed RPD precision criteria. As a result, all Watershed 5 groundwater sample results greater then the RMDL for round 2

were qualified as estimated for these analytes. RPD precision criteria was exceeded in only one other duplicate pair for round 2 (MXP31012/MDP31012) and for only one other analyte, aluminum. However, since aluminum had already been qualified for round two due to the duplicate pair from E3-P58-M01, no additional data were qualified.

F.5.2.2 Filtered Duplicates

The only analyte which was found to exceed RPD precision criteria in either round of groundwater sampling was antimony from duplicate pair MD1101F1/MF1101X1. As a result, only antimony found above the RMDL in round 1 filtered groundwater samples from Watershed 1B were qualified as estimated.

F.6 MATRIX SPIKE/MATRIX SPIKE DUPLICATES

Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples are collected and analyzed as a means of determining the physical effects of the matrix on the analytical results. MS/MSD samples were only collected for methods in which surrogate compounds were not used including TCL pesticides/PCBs, TAL metals, and explosives. The results of the 32 MS/MSD samples of various sample types collected at the Annex can be found in Table F-6.

The MS/MSD samples were evaluated on the basis of RPD values and percent recoveries as described in Volume I, Section 3.3.3. Control limits used for percent recovery for inorganic parameters were 75 percent to 125 percent. Control limits for organic parameters were based on limits established in the laboratory. Data exceeding these limits were qualified as estimated, "J", unless the recovery was below 30 percent for inorganics or 10 percent for organics and less than the RMDL/CRL. In these cases, the data were qualified as rejected and unusable, "R". Data for which the spiking amount was less than four times the native concentration were not qualified due to the difficulty of assessing the percent recovery in these cases.

Across all sample types collected at the Annex, only the following analytes exceeded precision criteria in at least one MS/MSD sample: silver, lead, antimony, selenium, mercury, manganese, aluminum, arsenic, chromium, dieldrin, DDT, 1,3,5-trinitrobenzene, endrin, lindane, cadmium, 2-nitrotoluene, barium, thallium, zinc, alpha-endosulfan, aldrin, dieldrin, heptachlor, cobalt, nickel, calcium, and nitrobenzene.

The compound 2-nitrotoluene exhibited low recoveries in only one MS/MSD sample set (WXBCK011). As a result, all facility wide surface water samples were qualified as estimated.

Arsenic was found to exceed precision criteria at six sites: P37, Puffer Pond, A06, Background, P02, and P54. However, of all samples, only the borings samples from Site P37 were qualified due to a low matrix spike recovery. All other samples were unaffected because arsenic was found in the method blank.

Barium was qualified as estimated only in water samples from Site P36, Background, and P37. In groundwater samples from Site P36, samples were qualified as estimated because of a high matrix spike recovery. Surface water samples from both background and Site P37 were qualified as estimated due to a low matrix spike recoveries.

Calcium was only found to exceed MS/MSD precision criteria in only one MS/MSD sample WXP37011. Due to a low matrix spike recovery, all surface water samples collected at Site P37 were qualified as estimated.

Mercury data was found to exceed precision criteria for borings samples at Site P37, sediments samples from Site A05, filtered groundwater samples from E3-P57-M01 in sampling round 2, and surface water samples from Site P58. In all cases, data for mercury were qualified as estimated due to low matrix spike recoveries, except for Site P58 which was qualified as estimated due to a high matrix spike recovery.

Endrin data were qualified as estimated due to inconsistent recoveries in the matrix spike and matrix spike duplicate samples from sediment samples from two sites: background and P37.

Alpha-endosulfan was found to have inconsistent recoveries between each of the MS/MSD samples from one sample only (DXP37021). As a result this compound was qualified as estimated.

Lindane was qualified as estimated for background sediment samples only due to high recoveries in the matrix spike and matrix spike duplicate analyses.

Magnesium in the matrix spike for groundwater samples taken from Site P36 had high recoveries, and for surface water samples taken from Site A05 had low recoveries. As a result magnesium data for three groundwater samples and one surface water sample were qualified as estimated.

Only surface water samples from Site P37 exceeded precision criteria due to low recoveries in the matrix spike for manganese. As a result, the three surface water samples from Site P37 were the only samples qualified.

Nickel recoveries in the MS/MSD sample BX360301 were high. As a result borings samples data from Site P36 were estimated.

Data from four sites (P37, P57, P28, and A06) were found to exceed precision criteria for DDT. The MS/MSD recoveries for DXP37021 were low which only affected sample DXP37031 since the samples DXP37011 and DXP37021 were unconfirmed. Sediment sample DXP57011 was qualified as estimated due to high recoveries as were the soil samples from Site A06. Soil samples from Site P28 were estimated due to inconsistent recoveries for DDT in the MS/MSD sample SX2801X1.

Antimony data from borings samples collected from Sites P36 and P01 were qualified as estimated due to low recoveries. Likewise excavation sample data from Sites A11, and P38 were qualified as estimated due to low recoveries. Soil sample data from Sites A02, P38, A06, background, P02, and P54 were also qualified due to low recoveries in the matrix spike. Groundwater sample data which were qualified as estimated due to low matrix spike recoveries were from Sites A10, P03, and P36. The only data which were affected due to high recoveries was a single sediment sample from Site P57 (DXP57011).

Selenium data from borings at Sites P36 and P01 were qualified as estimated due to low matrix spike recoveries. Selenium data from only one sediment sample (DXP57011) exceeded precision criteria. Since the matrix spike recovery was low, this data was estimated. The only excavation selenium data which were qualified as estimated were from Site P38 due to low recoveries. All groundwater selenium data which were qualified as estimated from MS/MSD precision review were due to low matrix spike recoveries Sites affected were A10, P02, P03, and P36. Selenium data for soils samples from Sites A02, P38, A06, background, and P02 were qualified due to low matrix spike recoveries.

Only background surface water sample data were affected by low recoveries for thallium in the matrix spike sample. As a result these samples were qualified as estimated.

F.7 SURROGATE SPIKES

Laboratory performance on individual samples is established by means of surrogate spikes. Surrogate compounds are added to every sample and blank sample prior to sample preparation. The evaluation of the results of these surrogate spikes is based upon control limits established by the laboratory in compliance with the USAEC QA Guidelines (May, 1993). Since the effects of the sample matrix frequently cause results to be outside laboratory control, surrogate spiking results that were considered acceptable in the laboratory control samples but not in the natural matrix were attributed to matrix effects. However, when the surrogate results were determined to be outside the established limits in the natural matrix as well as the laboratory control sample, an analytical problem was considered at fault. Therefore, the review and validation of data based on specific analytical results demands acute analytical experience and superior professional judgement.

Surrogate spiking data is summarized in Table F-7. All data was qualified for the surrogate spiking sample results by the laboratory with additional qualification assigned by the USAEC after review of weekly control chart submittals.

F.8 LABORATORY CONTROL SAMPLES

Laboratory control samples were run with each lot as described in Volume I, Section 3.2.2 and the QAPjP. The samples consisted of standard matrices spiked with a known quantity of analyte. If the standard matrix spike recoveries were outside of control limits, the samples were re-analyzed. If the holding time was exceeded and the samples could not be re-analyzed, the samples were recollected in the next field event if possible. The samples which

were recollected are described in the field sampling section for each site. Samples which could not reanalyzed or recollected were qualified by the USAEC Chemistry Branch and evaluated as part of the QA review. Most of the samples were either analyzed within acceptable control limits or were resampled.

For lots AAZR and AAVX, the standard matrix soil method blank analyzed with each lot exhibited varying low levels of zinc, The recovery of zinc in the low spike standard matrix soil was calculated by subtracting the method blank value. This resulted in high variability in the control limits and spike recoveries for zinc. Based on a review of the weekly control charts, the USAEC Chemistry Branch felt the zinc sample results in the associated samples should be rejected. Based on further review of the complete data package, it was determined that the standard matrix recoveries did not impact the sample results. However, the low levels of zinc in the samples were considered to be estimated because of the variable control limits.

F.9 SEDIMENT SAMPLES

Percent solids results for sediment samples are provided in Table F-8. The data quality objective for sediments was to achieve greater than 30 percent solids. E & E employed sampling techniques described in the work plan to achieve this goal while maintaining the representativeness of the sample. Samples with low percent solids were evaluated based on site conditions to determine if re-sampling would have improved the levels of solids.

Table F-1

Method Reporting Limits

Lab	Test	Method	Analyte	Test nm	Value	Units
EL	EXPLOSIVES	EXL1	1,3,5-Trinitrobenzene	135TNB	1.00000	UGG
EL	EXPLOSIVES	EXL1	1,3-Dinitrobenzene	13DNB	1.00000	UGG
EL	EXPLOSIVES	EXL1	2,4,6-Trinitrotoluene	246TNT	1.00000	UGG
EL	EXPLOSIVES	EXL1	2,4-DNT	24DNT	1.00000	UGG
EL	EXPLOSIVES	EXL1	2,6-DNT	26DNT	1.00000	UGG
EL	EXPLOSIVES	EXL1	2-Amino-4,6-dinitrotoluene	2A46DT	1.00000	UGG
EL	EXPLOSIVES	EXL1	2-Nitrotoluene	2NT	1.00000	UGG
EL	EXPLOSIVES	EXL1	3-Nitrotoluene	3NT	1.00000	UGG
EL	EXPLOSIVES	EXL1	4-Amino-2,6-dinitrotoluene	4A26DT	1.00000	UGG
EL	EXPLOSIVES	EXL1	4-Nitrotoluene	4NT	1.00000	UGG
EL	EXPLOSIVES	EXL1	HMX	HMX	1.00000	UGG
EL	EXPLOSIVES	EXL1	Nitrobenzene	NB	1.00000	UGG
EL	EXPLOSIVES	EXL1	Cyclonite	RDX	1.00000	UGG
EL	EXPLOSIVES	EXL1	Tetryl, total	TETRYL	1.00000	UGG
EL	EXPLOSIVES	EXL2	Nitroglycerine	NG	10.00000	UGG
EL	EXPLOSIVES	EXL2	PETN	PETN	10.00000	UGG
EL	EXPLOSIVES	EXL1	1,3,5-Trinitrobenzene	135TNB	1.00000	UGL
EL	EXPLOSIVES	EXL1	1,3-Dinitrobenzene	13DNB	1.00000	UGL
EL	EXPLOSIVES	EXL1	2,4,6-Trinitrotoluene	246TNT	1.00000	UGL
EL	EXPLOSIVES	EXL1	2,4-DNT	24DNT	1.00000	UGL
EL	EXPLOSIVES	EXL1	2,6-DNT	26DNT	1.00000	UGL
EL	EXPLOSIVES	EXL1	2-Amino-4,6-dinitrotoluene	2A46DT	1.00000	UGL
EL	EXPLOSIVES	EXL1	2-Nitrotoluene	2NT	1.00000	UGL
EL	EXPLOSIVES	EXL1	3-Nitrotoluene	3NT	1.00000	UGL
EL	EXPLOSIVES	EXL1	4-Amino-2,6-dinitrotoluene	4A26DT	1.00000	UGL
EL	EXPLOSIVES	EXL1	4-Nitrotoluene	4NT	1.00000	UGL
EL	EXPLOSIVES	EXL1	HMX	HMX	1.00000	UGL
EL	EXPLOSIVES	EXL1	Nitrobenzene	NB	1.00000	UGL
EL	EXPLOSIVES	EXL1	Cyclonite	RDX	1.00000	UGL
EL	EXPLOSIVES	EXL1	Tetryl, total	TETRYL	1.00000	UGL
EL	EXPLOSIVES	EXL2	Nitroglycerine	NG	10.00000	UGL
EL	EXPLOSIVES	EXL2	PETN	PETN	10.00000	UGL
EL	TAL METAL	GAS1	Arsenic	AS	0.20000	UGG
EL	TAL METAL	GSB1	Antimony	SB	0.50000	UGG
EL	TAL METAL	GSE1	Selenium	SE	0.20000	UGG
EL	TAL METAL	GTL1	Thallium	TL	0.50000	UGG
EL	TAL METAL	HGC1	Mercury	HG	0.10000	UGG
EL	TAL METAL	ICP1	Silver	AG	0.20000	UGG
EL	TAL METAL	ICP1	Aluminum	AL	300.00000	UGG
EL	TAL METAL	ICP1	Barium	BA	5.00000	UGG
EL	TAL METAL	ICP1	Beryllium	BE	0.50000	UGG
EL	TAL METAL	ICP1	Calcium	CA	500.00000	UGG
EL	TAL METAL	ICP1	Cadmium	CD	0.50000	UGG
EL	TAL METAL	ICP1	Cobalt	CO	1.00000	UGG
EL	TAL METAL	ICP1	Chromium	CR	2.00000	UGG
EL	TAL METAL	ICP1	Iron	FE	350.00000	UGG
EL	TAL METAL	ICP1	Potassium	K	200.00000	UGG
EL	TAL METAL	ICP1	Magnesium	MG	500.00000	UGG
EL	TAL METAL	ICP1	Sodium	NA	200.00000	UGG

Table F-1

Method Reporting Limits

Lab	Test	Method	Analyte	Test nm	Value	Units
EL	TAL METAL	ICP1	Nickel	NI	1.00000	UGG
EL	TAL METAL	ICP1	Zinc	ZN	2.00000	UGG
EL	TAL METAL	GAS1	Arsenic	AS	2.00000	UGL
EL	TAL METAL	GPB1	Lead	PB	5.00000	UGL
EL	TAL METAL	GSB1	Antimony	SB	5.00000	UGL
EL	TAL METAL	GSE1	Selenium	SE	2.00000	UGL
EL	TAL METAL	GTL1	Thallium	TL	2.00000	UGL
EL	TAL METAL	HGC1	Mercury	HG	0.20000	UGL
EL	TAL METAL	ICP1	Silver	AG	2.00000	UGL
EL	TAL METAL	ICP1	Aluminum	AL	25.00000	UGL
EL	TAL METAL	ICP1	Barium	BA	10.00000	UGL
EL	TAL METAL	ICP1	Beryllium	BE	5.00000	UGL
EL	TAL METAL	ICP1	Calcium	CA	500.00000	UGL
EL	TAL METAL	ICP1	Cadmium	CD	5.00000	UGL
EL	TAL METAL	ICP1	Cobalt	CO	10.00000	UGL
EL	TAL METAL	ICP1	Chromium	CR	10.00000	UGL
EL	TAL METAL	ICP1	Copper	CU	10.00000	UGL
EL	TAL METAL	ICP1	Iron	FE	25.00000	UGL
EL	TAL METAL	ICP1	Potassium	K	1000.00000	UGL
EL	TAL METAL	ICP1	Magnesium	MG	500.00000	UGL
EL	TAL METAL	ICP1	Manganese	MN	5.00000	UGL
EL	TAL METAL	ICP1	Sodium	NA	2000.00000	UGL
EL	TAL METAL	ICP1	Nickel	NI	10.00000	UGL
EL	TAL METAL	ICP1	Vanadium	V	10.00000	UGL
EL	TAL METAL	ICP1	Zinc	ZN	20.00000	UGL
EL	TCL BNA	SMV1	1,2,4-Trichlorobenzene	124TCB	0.33000	UGG
EL	TCL BNA	SMV1	1,2-Dichlorobenzene	12DCLB	0.33000	UGG
EL	TCL BNA	SMV1	1,3-Dichlorobenzene	13DCLB	0.33000	UGG
EL	TCL BNA	SMV1	1,4-Dichlorobenzene	14DCLB	0.33000	UGG
EL	TCL BNA	SMV1	2,4,5-Trichlorophenol	245TCP	0.33000	UGG
EL	TCL BNA	SMV1	2,4,6-Trichlorophenol	246TCP	0.33000	UGG
EL	TCL BNA	SMV1	2,4-Dichlorophenol	24DCLP	0.33000	UGG
EL	TCL BNA	SMV1	2,4-Dimethylphenol	24DMPN	0.33000	UGG
EL	TCL BNA	SMV1	2,4-Dinitrophenol	24DNP	0.33000	UGG
EL	TCL BNA	SMV1	2,4-DNT	24DNT	0.33000	UGG
EL	TCL BNA	SMV1	2,6-DNT	26DNT	0.33000	UGG
EL	TCL BNA	SMV1	2-Chlorophenol	2CLP	0.33000	UGG
EL	TCL BNA	SMV1	2-Chloronaphthalene	2CNAP	0.33000	UGG
EL	TCL BNA	SMV1	2-Methylnaphthalene	2MNAP	0.33000	UGG
EL	TCL BNA	SMV1	2-Methyl phenol	2MP	0.33000	UGG
EL	TCL BNA	SMV1	2-Nitroaniline	2NANIL	0.66000	UGG
EL	TCL BNA	SMV1	2-Nitrophenol	2NP	0.33000	UGG
EL	TCL BNA	SMV1	3,3'-Dichlorobenzidine	33DCBD	0.66000	UGG
EL	TCL BNA	SMV1	3-Nitroaniline	3NANIL	0.66000	UGG
EL	TCL BNA	SMV1	4,6-Dinitro-2-methylphenol	46DN2C	0.33000	UGG
EL	TCL BNA	SMV1	4-Bromophenyl phenyl ether	4BRPPE	0.33000	UGG
EL	TCL BNA	SMV1	4-Chloroaniline	4CANIL	0.33000	UGG
EL	TCL BNA	SMV1	4-Chloro-3-methylphenol	4CL3C	0.33000	UGG
EL	TCL BNA	SMV1	4-Chlorophenyl phenyl ether	4CLPPE	0.33000	UGG
EL	TCL BNA	SMV1	4-Methyl phenol	4MP	0.33000	UGG

Table F-1

Method Reporting Limits

Lab	Test	Method	Analyte	Test nm	Value	Units
EL	TCL BNA	SMV1	4-Nitroaniline	4NANIL	0.66000	UGG
EL	TCL BNA	SMV1	4-Nitrophenol	4NP	0.66000	UGG
EL	TCL BNA	SMV1	Acenaphthene	ANAPNE	0.33000	UGG
EL	TCL BNA	SMV1	Acenaphthylene	ANAPYL	0.33000	UGG
EL	TCL BNA	SMV1	Anthracene	ANTRC	0.33000	UGG
EL	TCL BNA	SMV1	Bis (2-chloroethoxy) methane	B2CEXM	0.33000	UGG
EL	TCL BNA	SMV1	Bis(2-chloroisopropyl) ether	B2CIPE	0.33000	UGG
EL	TCL BNA	SMV1	Bis(2-chloroethyl)ether	B2CLEE	0.33000	UGG
EL	TCL BNA	SMV1	Bis(2-ethylhexyl)phthalate	B2EHP	0.33000	UGG
EL	TCL BNA	SMV1	Benzo(a)anthracene	BAANTR	0.33000	UGG
EL	TCL BNA	SMV1	Benzo(a)pyrene	BAPYR	0.33000	UGG
EL	TCL BNA	SMV1	Benzo(b)fluoranthene	BBFANT	0.33000	UGG
EL	TCL BNA	SMV1	Butyl benzyl phthalate	BBZP	0.33000	UGG
EL	TCL BNA	SMV1	Benzo(ghi)perylene	BGHIPY	0.33000	UGG
EL	TCL BNA	SMV1	Benzo(k)fluoranthene	BKFANT	0.33000	UGG
EL	TCL BNA	SMV1	Chrysene	CHRY	0.33000	UGG
EL	TCL BNA	SMV1	Hexachlorobenzene	CL6BZ	0.33000	UGG
EL	TCL BNA	SMV1	Hexachlorocyclopentadiene	CL6CP	0.33000	UGG
EL	TCL BNA	SMV1	Hexachloroethane	CL6ET	0.33000	UGG
EL	TCL BNA	SMV1	Dibenzo(a,h)anthracene	DBAHA	0.33000	UGG
EL	TCL BNA	SMV1	Dibenzofuran	DBZFUR	0.33000	UGG
EL	TCL BNA	SMV1	Diethyl phthalate	DEP	0.33000	UGG
EL	TCL BNA	SMV1	Dimethyl phthalate	DMP	0.33000	UGG
EL	TCL BNA	SMV1	Di-n-butyl-phthalate	DNBP	0.33000	UGG
EL	TCL BNA	SMV1	Di-n-octyl phthalate	DNOP	0.33000	UGG
EL	TCL BNA	SMV1	Fluoranthene	FANT	0.33000	UGG
EL	TCL BNA	SMV1	Fluorene	FLRENE	0.33000	UGG
EL	TCL BNA	SMV1	Hexachlorobutadiene	HCBD	0.33000	UGG
EL	TCL BNA	SMV1	Indeno(1,2,3-cd)pyrene	ICDPYR	0.33000	UGG
EL	TCL BNA	SMV1	Isophorone	ISOPHR	0.33000	UGG
EL	TCL BNA	SMV1	Naphthalene	NAP	0.33000	UGG
EL	TCL BNA	SMV1	Nitrobenzene	NB	0.33000	UGG
EL	TCL BNA	SMV1	N-nitrosodipropylamine	NNDNPA	0.33000	UGG
EL	TCL BNA	SMV1	N-nitrosodiphenylamine	NNDPA	0.33000	UGG
EL	TCL BNA	SMV1	Pentachlorophenol	PCP	0.66000	UGG
EL	TCL BNA	SMV1	Phenanthrene	PHANTR	0.33000	UGG
EL	TCL BNA	SMV1	Phenol	PHENOL	0.33000	UGG
EL	TCL BNA	SMV1	Pyrene	PYR	0.33000	UGG
EL	TCL BNA	SMV1	1,2,4-Trichlorobenzene	124TCB	10.00000	UGL
EL	TCL BNA	SMV1	1,2-Dichlorobenzene	12DCLB	10.00000	UGL
EL	TCL BNA	SMV1	1,3-Dichlorobenzene	13DCLB	10.00000	UGL
EL	TCL BNA	SMV1	1,4-Dichlorobenzene	14DCLB	10.00000	UGL
EL	TCL BNA	SMV1	2,4,5-Trichlorophenol	245TCP	20.00000	UGL
EL	TCL BNA	SMV1	2,4,6-Trichlorophenol	246TCP	20.00000	UGL
EL	TCL BNA	SMV1	2,4-Dichlorophenol	24DCLP	10.00000	UGL
EL	TCL BNA	SMV1	2,4-Dimethylphenol	24DMPN	20.00000	UGL
EL	TCL BNA	SMV1	2,4-Dinitrophenol	24DNP	20.00000	UGL
EL	TCL BNA	SMV1	2,4-DNT	24DNT	10.00000	UGL
EL	TCL BNA	SMV1	2,6-DNT	26DNT	10.00000	UGL
EL	TCL BNA	SMV1	2-Chlorophenol	2CLP	10.00000	UGL
EL	TCL BNA	SMV1	2-Chloronaphthalene	2CNAP	10.00000	UGL

Table F-1

Method Reporting Limits

Lab	Test	Method	Analyte	Test nm	Value	Units
EL	TCL BNA	SMV1	2-Methylnaphthalene	2MNAP	10.00000	UGL
EL	TCL BNA	SMV1	2-Methyl phenol	2MP	20.00000	UGL
EL	TCL BNA	SMV1	2-Nitroaniline	2NANIL	20.00000	UGL
EL	TCL BNA	SMV1	2-Nitrophenol	2NP	10.00000	UGL
EL	TCL BNA	SMV1	3,3'-Dichlorobenzidine	33DCBD	20.00000	UGL
EL	TCL BNA	SMV1	3-Nitroaniline	3NANIL	20.00000	UGL
EL	TCL BNA	SMV1	4,6-Dinitro-2-methylphenol	46DN2C	20.00000	UGL
EL	TCL BNA	SMV1	4-Bromophenyl phenyl ether	4BRPPE	10.00000	UGL
EL	TCL BNA	SMV1	4-Chloroaniline	4CANIL	20.00000	UGL
EL	TCL BNA	SMV1	4-Chloro-3-methylphenol	4CL3C	10.00000	UGL
EL	TCL BNA	SMV1	4-Chlorophenyl phenyl ether	4CLPPE	10.00000	UGL
EL	TCL BNA	SMV1	4-Methyl phenol	4MP	10.00000	UGL
EL	TCL BNA	SMV1	4-Nitroaniline	4NANIL	20.00000	UGL
EL	TCL BNA	SMV1	4-Nitrophenol	4NP	20.00000	UGL
EL	TCL BNA	SMV1	Acenaphthene	ANAPNE	10.00000	UGL
EL	TCL BNA	SMV1	Acenaphthylene	ANAPYL	10.00000	UGL
EL	TCL BNA	SMV1	Anthracene	ANTRC	10.00000	UGL
EL	TCL BNA	SMV1	Bis (2-chloroethoxy) methane	B2CEXM	10.00000	UGL
EL	TCL BNA	SMV1	Bis(2-chloroisopropyl) ether	B2CIPE	10.00000	UGL
EL	TCL BNA	SMV1	Bis(2-chloroethyl)ether	B2CLEE	10.00000	UGL
EL	TCL BNA	SMV1	Bis(2-ethylhexyl)phthalate	B2EHP	10.00000	UGL
EL	TCL BNA	SMV1	Benzo(a)anthracene	BAANTR	10.00000	UGL
EL	TCL BNA	SMV1	Benzo(a)pyrene	BAPYR	10.00000	UGL
EL	TCL BNA	SMV1	Benzo(b)fluoranthene	BBFANT	10.00000	UGL
EL	TCL BNA	SMV1	Butyl benzyl phthalate	BBZP	10.00000	UGL
EL	TCL BNA	SMV1	Benzo(ghi)perylene	BGHIPY	10.00000	UGL
EL	TCL BNA	SMV1	Benzo(k)fluoranthene	BKFANT	10.00000	UGL
EL	TCL BNA	SMV1	Chrysene	CHRY	10.00000	UGL
EL	TCL BNA	SMV1	Hexachlorobenzene	CL6BZ	10.00000	UGL
EL	TCL BNA	SMV1	Hexachlorocyclopentadiene	CL6CP	10.00000	UGL
EL	TCL BNA	SMV1	Hexachloroethane	CL6ET	10.00000	UGL
EL	TCL BNA	SMV1	Dibenzo(a,h)anthracene	DBAHA	10.00000	UGL
EL	TCL BNA	SMV1	Dibenzofuran	DBZFUR	20.00000	UGL
EL	TCL BNA	SMV1	Diethyl phthalate	DEP	10.00000	UGL
EL	TCL BNA	SMV1	Dimethyl phthalate	DMP	10.00000	UGL
EL	TCL BNA	SMV1	Di-n-butyl-phthalate	DNBP	10.00000	UGL
EL	TCL BNA	SMV1	Di-n-octyl phthalate	DNOP	10.00000	UGL
EL	TCL BNA	SMV1	Fluoranthene	FANT	10.00000	UGL
EL	TCL BNA	SMV1	Fluorene	FLRENE	10.00000	UGL
EL	TCL BNA	SMV1	Hexachlorobutadiene	HCBD	10.00000	UGL
EL	TCL BNA	SMV1	Indeno(1,2,3-cd)pyrene	ICDPYR	10.00000	UGL
EL	TCL BNA	SMV1	Isophorone	ISOPHR	10.00000	UGL
EL	TCL BNA	SMV1	Naphthalene	NAP	10.00000	UGL
EL	TCL BNA	SMV1	Nitrobenzene	NB	10.00000	UGL
EL	TCL BNA	SMV1	N-nitrosodipropylamine	NNDNPA	10.00000	UGL
EL	TCL BNA	SMV1	N-nitrosodiphenylamine	NNDPA	10.00000	UGL
EL	TCL BNA	SMV1	Pentachlorophenol	PCP	20.00000	UGL
EL	TCL BNA	SMV1	Phenanthrene	PHANTR	10.00000	UGL
EL	TCL BNA	SMV1	Phenol	PHENOL	10.00000	UGL
EL	TCL BNA	SMV1	Pyrene	PYR	10.00000	UGL
EL	TCL Pest	PST1	alpha-BHC	ABHC	0.00100	UGG

Table F-1

Method Reporting Limits

Lab	Test	Method	Analyte	Test nm	Value	Units
EL	TCL Pest	PST1	Endosulfan,A	AENSLF	0.00100	UGG
EL	TCL Pest	PST1	Aldrin	ALDRN	0.00100	UGG
EL	TCL Pest	PST1	beta-BHC	BBHC	0.00100	UGG
EL	TCL Pest	PST1	Endosulfan,B	BENSLF	0.00200	UGG
EL	TCL Pest	PST1	Chlordane	CLDAN	0.00800	UGG
EL	TCL Pest	PST1	delta-BHC	DBHC	0.00100	UGG
EL	TCL Pest	PST1	Dieldrin	DLDRN	0.00200	UGG
EL	TCL Pest	PST1	Endrin	ENDRN	0.00200	UGG
EL	TCL Pest	PST1	Endrin Aldehyde	ENDRNA	0.00200	UGG
EL	TCL Pest	PST1	Endosulfan Sulfate	ESFSO4	0.00200	UGG
EL	TCL Pest	PST1	Heptachlor	HPCL	0.00100	UGG
EL	TCL Pest	PST1	Heptachlor Epoxide	HPCLE	0.00100	UGG
EL	TCL Pest	PST1	Lindane	LIN	0.00100	UGG
EL	TCL Pest	PST1	Methoxychlor	MEXCLR	0.00800	UGG
EL	TCL Pest	PST1	PCB-1016	PCB016	0.02000	UGG
EL	TCL Pest	PST1	PCB-1221	PCB221	0.03300	UGG
EL	TCL Pest	PST1	PCB-1232	PCB232	0.02000	UGG
EL	TCL Pest	PST1	PCB-1242	PCB242	0.02000	UGG
EL	TCL Pest	PST1	PCB-1248	PCB248	0.02000	UGG
EL	TCL Pest	PST1	PCB-1254	PCB254	0.02000	UGG
EL	TCL Pest	PST1	PCB-1260	PCB260	0.02000	UGG
EL	TCL Pest	PST1	P,P-DDD	PPDDD	0.00200	UGG
EL	TCL Pest	PST1	P,P-DDE	PPDDE	0.00200	UGG
EL	TCL Pest	PST1	P,P-DDT	PPDDT	0.00200	UGG
EL	TCL Pest	PST1	Toxaphene	TXPHEN	0.03300	UGG
EL	TCL Pest	PST1	alpha-BHC	ABHC	0.02000	UGL
EL	TCL Pest	PST1	Endosulfan,A	AENSLF	0.02000	UGL
EL	TCL Pest	PST1	Aldrin	ALDRN	0.02000	UGL
EL	TCL Pest	PST1	beta-BHC	BBHC	0.02000	UGL
EL	TCL Pest	PST1	Endosulfan,B	BENSLF	0.04000	UGL
EL	TCL Pest	PST1	Chlordane	CLDAN	0.10000	UGL
EL	TCL Pest	PST1	delta-BHC	DBHC	0.02000	UGL
EL	TCL Pest	PST1	Dieldrin	DLDRN	0.04000	UGL
EL	TCL Pest	PST1	Endrin	ENDRN	0.04000	UGL
EL	TCL Pest	PST1	Endrin Aldehyde	ENDRNA	0.10000	UGL
EL	TCL Pest	PST1	Endosulfan Sulfate	ESFSO4	0.04000	UGL
EL	TCL Pest	PST1	Heptachlor	HPCL	0.02000	UGL
EL	TCL Pest	PST1	Heptachlor Epoxide	HPCLE	0.02000	UGL
EL	TCL Pest	PST1	Lindane	LIN	0.02000	UGL
EL	TCL Pest	PST1	Methoxychlor	MEXCLR	0.20000	UGL
EL	TCL Pest	PST1	PCB-1016	PCB016	0.50000	UGL
EL	TCL Pest	PST1	PCB-1221	PCB221	1.00000	UGL
EL	TCL Pest	PST1	PCB-1232	PCB232	0.50000	UGL
EL	TCL Pest	PST1	PCB-1242	PCB242	0.50000	UGL
EL	TCL Pest	PST1	PCB-1248	PCB248	0.50000	UGL
EL	TCL Pest	PST1	PCB-1254	PCB254	0.50000	UGL
EL	TCL Pest	PST1	PCB-1260	PCB260	0.50000	UGL
EL	TCL Pest	PST1	P,P-DDD	PPDDD	0.04000	UGL
EL	TCL Pest	PST1	P,P-DDE	PPDDE	0.04000	UGL
EL	TCL Pest	PST1	P,P-DDT	PPDDT	0.04000	UGL
EL	TCL Pest	PST1	Toxaphene	TXPHEN	1.00000	UGL

Table F-1

Method Reporting Limits

Lab	Test	Method	Analyte	Test nm	Value	Units
EL	TCL VOA	VMS1	1,1,1-Trichloroethane	111TCE	0.00500	UGG
EL	TCL VOA	VMS1	1,1,2-Trichloroethane	112TCE	0.00500	UGG
EL	TCL VOA	VMS1	1,1-Dichloroethene	11DCE	0.00500	UGG
EL	TCL VOA	VMS1	1,1-Dichloroethane	11DCLE	0.00500	UGG
EL	TCL VOA	VMS1	1,2-Dichloroethane	12DCLE	0.00500	UGG
EL	TCL VOA	VMS1	1,2-Dichloropropane	12DCLP	0.00500	UGG
EL	TCL VOA	VMS1	12DMB	12DMB	0.00500	UGG
EL	TCL VOA	VMS1	134DMB	134DMB	0.00500	UGG
EL	TCL VOA	VMS1	Acetone	ACET	0.10000	UGG
EL	TCL VOA	VMS1	Bromodichloromethane	BRDCLM	0.00500	UGG
EL	TCL VOA	VMS1	C12DCE	C12DCE	0.00500	UGG
EL	TCL VOA	VMS1	cis-1,3-dichloropropene	C13DCP	0.00500	UGG
EL	TCL VOA	VMS1	Vinyl Chloride	C2H3CL	0.01000	UGG
EL	TCL VOA	VMS1	Chloroethane	C2H5CL	0.01000	UGG
EL	TCL VOA	VMS1	Benzene	C6H6	0.00500	UGG
EL	TCL VOA	VMS1	Carbon tetrachloride	CCL4	0.00500	UGG
EL	TCL VOA	VMS1	Methylene chloride	CH2CL2	0.01000	UGG
EL	TCL VOA	VMS1	Bromomethane	CH3BR	0.01000	UGG
EL	TCL VOA	VMS1	Chloromethane	CH3CL	0.01000	UGG
EL	TCL VOA	VMS1	Bromoform	CHBR3	0.00500	UGG
EL	TCL VOA	VMS1	Chloroform	CHCL3	0.00500	UGG
EL	TCL VOA	VMS1	Chlorobenzene	CLC6H5	0.00500	UGG
EL	TCL VOA	VMS1	Carbon disulfide	CS2	0.00500	UGG
EL	TCL VOA	VMS1	Dibromochloromethane	DBRCLM	0.00500	UGG
EL	TCL VOA	VMS1	Ethylbenzene	ETC6H5	0.00500	UGG
EL	TCL VOA	VMS1	Toluene	MEC6H5	0.00500	UGG
EL	TCL VOA	VMS1	2-Butanone	MEK	0.01000	UGG
EL	TCL VOA	VMS1	Methylisobutyl ketone	MIBK	0.01000	UGG
EL	TCL VOA	VMS1	2-Hexanone	MNBK	0.01000	UGG
EL	TCL VOA	VMS1	Styrene	STYR	0.00500	UGG
EL	TCL VOA	VMS1	T12DCE	T12DCE	0.00500	UGG
EL	TCL VOA	VMS1	trans-1,3-dichloropropene	T13DCP	0.00500	UGG
EL	TCL VOA	VMS1	1,1,2,2-Tetrachloroethane	TCLEA	0.00500	UGG
EL	TCL VOA	VMS1	Tetrachloroethene	TCLEE	0.00500	UGG
EL	TCL VOA	VMS1	Trichloroethene	TRCLE	0.00500	UGG
EL	TCL VOA	VMS1	1,1,1-Trichloroethane	111TCE	5.00000	UGL
EL	TCL VOA	VMS1	1,1,2-Trichloroethane	112TCE	5.00000	UGL
EL	TCL VOA	VMS1	1,1-Dichloroethene	11DCE	5.00000	UGL
EL	TCL VOA	VMS1	1,1-Dichloroethane	11DCLE	5.00000	UGL
EL	TCL VOA	VMS1	1,2-Dichloroethane	12DCLE	5.00000	UGL
EL	TCL VOA	VMS1	1,2-Dichloropropane	12DCLP	5.00000	UGL
EL	TCL VOA	VMS1	12DMB	12DMB	5.00000	UGL
EL	TCL VOA	VMS1	134DMB	134DMB	10.00000	UGL
EL	TCL VOA	VMS1	Acetone	ACET	10.00000	UGL
EL	TCL VOA	VMS1	Bromodichloromethane	BRDCLM	5.00000	UGL
EL	TCL VOA	VMS1	C12DCE	C12DCE	5.00000	UGL
EL	TCL VOA	VMS1	cis-1,3-dichloropropene	C13DCP	5.00000	UGL
EL	TCL VOA	VMS1	Vinyl Chloride	C2H3CL	10.00000	UGL
EL	TCL VOA	VMS1	Chloroethane	C2H5CL	10.00000	UGL
EL	TCL VOA	VMS1	Benzene	C6H6	5.00000	UGL

Table F-1

Method Reporting Limits

Lab	Test	Method	Analyte	Test nm	Value	Units
EL	TCL VOA	VMS1	Carbon tetrachloride	CCL4	5.00000	UGL
EL	TCL VOA	VMS1	Methylene chloride	CH2CL2	5.00000	UGL
EL	TCL VOA	VMS1	Bromomethane	CH3BR	10.00000	UGL
EL	TCL VOA	VMS1	Chloromethane	CH3CL	10.00000	UGL
EL	TCL VOA	VMS1	Bromoform	CHBR3	5.00000	UGL
EL	TCL VOA	VMS1	Chloroform	CHCL3	5.00000	UGL
EL	TCL VOA	VMS1	Chlorobenzene	CLC6H5	5.00000	UGL
EL	TCL VOA	VMS1	Carbon disulfide	CS2	5.00000	UGL
EL	TCL VOA	VMS1	Dibromochloromethane	DBRCLM	5.00000	UGL
EL	TCL VOA	VMS1	Ethylbenzene	ETC6H5	5.00000	UGL
EL	TCL VOA	VMS1	Toluene	MEC6H5	5.00000	UGL
EL	TCL VOA	VMS1	2-Butanone	MEK	10.00000	UGL
EL	TCL VOA	VMS1	Methylisobutyl ketone	MIBK	10.00000	UGL
EL	TCL VOA	VMS1	2-Hexanone	MNBK	10.00000	UGL
EL	TCL VOA	VMS1	Styrene	STYR	5.00000	UGL
EL	TCL VOA	VMS1	T12DCE	T12DCE	5.00000	UGL
EL	TCL VOA	VMS1	trans-1,3-dichloropropene	T13DCP	5.00000	UGL
EL	TCL VOA	VMS1	1,1,2,2-Tetrachloroethane	TCLEA	5.00000	UGL
EL	TCL VOA	VMS1	Tetrachloroethene	TCLEE	5.00000	UGL
EL	TCL VOA	VMS1	Trichloroethene	TRCLE	5.00000	UGL
EL	TOC	*00*	*Total Organic Carbon*	TOC	1.00000	UGG
EL	TPHC	TPH1	Total Petroleum Hydrocarbons	TPHC	20.00000	UGG
EL	WQP	3652	Phosphorus, Total	P4	10.00000	UGL
EL	WQP	ANI1	Nitrite	NO2	100.00000	UGL
EL	WQP	ANI1	Nitrate	NO3	100.00000	UGL
EL	WQP	ANI2	Nitrite	NO2	100.00000	UGL
EL	WQP	ANI2	Nitrate	NO3	100.00000	UGL
EL	WQP	ANI2	Orthophosphate	PO4ORT	200.00000	UGL
ES	LH11	LH11	245T	245T	0.00600	UGG
ES	LH11	LH11	245TP	245TP	0.00800	UGG
ES	LH11	LH11	24D	24D	0.01800	UGG
ES	LN05	LN05	ATZ	ATZ	0.25000	UGG
ES	LN05	LN05	CPYR	CPYR	0.05000	UGG
ES	LN05	LN05	DDVP	DDVP	0.45200	UGG
ES	LN05	LN05	DIAZ	DIAZ	32.80000	UGG
ES	LN05	LN05	MLTHN	MLTHN	0.58000	UGG
ES	LN05	LN05	MPRTHN	MPRTHN	32.70000	UGG
ES	LN05	LN05	PRTHN	PRTHN	0.73300	UGG
ES	LN05	LN05	RON	RON	0.05000	UGG
ES	LN05	LN05	SUPONA	SUPONA	0.25000	UGG
ES	UH14	UH14	245T	245T	0.07500	UGL
ES	UH14	UH14	245TP	245TP	0.17000	UGL
ES	UH14	UH14	24D	24D	0.80200	UGL
ES	UN07	UN07	ATZ	ATZ	0.51200	UGL
ES	UN07	UN07	CPYR	CPYR	0.32000	UGL
ES	UN07	UN07	DDVP	DDVP	0.25000	UGL
ES	UN07	UN07	DIAZ	DIAZ	0.31000	UGL
ES	UN07	UN07	MLTHN	MLTHN	0.25000	UGL

Table F-1

Method Reporting Limits

Lab	Test	Method	Analyte	Test nm	Value	Units
ES	UN07	UN07	MPRTHN	MPRTHN	0.30600	UGL
ES	UN07	UN07	PRTHN	PRTHN	0.25000	UGL
ES	UN07	UN07	RON	RON	0.30700	UGL
ES	UN07	UN07	SUPONA	SUPONA	0.23500	UGL
UB	TCL BNA	SMV1	1,2,4-Trichlorobenzene	124TCB	0.66000	UGG
UB	TCL BNA	SMV1	1,2-Dichlorobenzene	12DCLB	0.66000	UGG
UB	TCL BNA	SMV1	1,3-Dichlorobenzene	13DCLB	0.66000	UGG
UB	TCL BNA	SMV1	1,4-Dichlorobenzene	14DCLB	0.66000	UGG
UB	TCL BNA	SMV1	2,4,5-Trichlorophenol	245TCP	0.66000	UGG
UB	TCL BNA	SMV1	2,4,6-Trichlorophenol	246TCP	0.66000	UGG
UB	TCL BNA	SMV1	2,4-Dichlorophenol	24DCLP	0.66000	UGG
UB	TCL BNA	SMV1	2,4-Dimethylphenol	24DMPN	0.66000	UGG
UB	TCL BNA	SMV1	2,4-Dinitrophenol	24DNP	0.66000	UGG
UB	TCL BNA	SMV1	2,4-DNT	24DNT	0.66000	UGG
UB	TCL BNA	SMV1	2,6-DNT	26DNT	0.66000	UGG
UB	TCL BNA	SMV1	2-Chlorophenol	2CLP	0.66000	UGG
UB	TCL BNA	SMV1	2-Chloronaphthalene	2CNAP	0.66000	UGG
UB	TCL BNA	SMV1	2-Methylnaphthalene	2MNAP	0.66000	UGG
UB	TCL BNA	SMV1	2-Methyl phenol	2MP	0.66000	UGG
UB	TCL BNA	SMV1	2-Nitroaniline	2NANIL	1.70000	UGG
UB	TCL BNA	SMV1	2-Nitrophenol	2NP	1.70000	UGG
UB	TCL BNA	SMV1	3,3'-Dichlorobenzidine	33DCBD	0.66000	UGG
UB	TCL BNA	SMV1	3-Nitroaniline	3NANIL	1.70000	UGG
UB	TCL BNA	SMV1	4,6-Dinitro-2-methylphenol	46DN2C	1.70000	UGG
UB	TCL BNA	SMV1	4-Bromophenyl phenyl ether	4BRPPE	0.66000	UGG
UB	TCL BNA	SMV1	4-Chloroaniline	4CANIL	0.66000	UGG
UB	TCL BNA	SMV1	4-Chloro-3-methylphenol	4CL3C	0.66000	UGG
UB	TCL BNA	SMV1	4-Chlorophenyl phenyl ether	4CLPPE	0.66000	UGG
UB	TCL BNA	SMV1	4-Methyl phenol	4MP	0.66000	UGG
UB	TCL BNA	SMV1	4-Nitroaniline	4NANIL	1.70000	UGG
UB	TCL BNA	SMV1	4-Nitrophenol	4NP	1.70000	UGG
UB	TCL BNA	SMV1	Acenaphthene	ANAPNE	0.66000	UGG
UB	TCL BNA	SMV1	Acenaphthylene	ANAPYL	0.66000	UGG
UB	TCL BNA	SMV1	Anthracene	ANTRC	0.66000	UGG
UB	TCL BNA	SMV1	Bis (2-chloroethoxy) methane	B2CEXM	0.66000	UGG
UB	TCL BNA	SMV1	Bis(2-chloroethyl)ether	B2CLEE	0.66000	UGG
UB	TCL BNA	SMV1	Bis(2-ethylhexyl)phthalate	B2EHP	0.66000	UGG
UB	TCL BNA	SMV1	Benzo(a)anthracene	BAANTR	0.66000	UGG
UB	TCL BNA	SMV1	Benzo(a)pyrene	BAPYR	0.66000	UGG
UB	TCL BNA	SMV1	Benzo(b)fluoranthene	BBFANT	0.66000	UGG
UB	TCL BNA	SMV1	Butyl benzyl phthalate	BBZP	0.66000	UGG
UB	TCL BNA	SMV1	Benzoic acid	BENZOA	1.70000	UGG
UB	TCL BNA	SMV1	Benzo(ghi)perylene	BGHIPY	0.66000	UGG
UB	TCL BNA	SMV1	Benzo(k)fluoranthene	BKFANT	0.66000	UGG
UB	TCL BNA	SMV1	Benzyl Alcohol	BZALC	0.66000	UGG
UB	TCL BNA	SMV1	Chrysene	CHRY	0.66000	UGG
UB	TCL BNA	SMV1	Hexachlorobenzene	CL6BZ	0.66000	UGG
UB	TCL BNA	SMV1	Hexachlorocyclopentadiene	CL6CP	0.66000	UGG
UB	TCL BNA	SMV1	Hexachloroethane	CL6ET	0.66000	UGG
UB	TCL BNA	SMV1	Dibenzo(a,h)anthracene	DBAHA	0.66000	UGG
UB	TCL BNA	SMV1	Dibenzofuran	DBZFUR	0.66000	UGG

Table F-1

Method Reporting Limits

Lab	Test	Method	Analyte	Test nm	Value	Units
UB	TCL BNA	SMV1	Diethyl phthalate	DEP	0.66000	UGG
UB	TCL BNA	SMV1	Dimethyl phthalate	DMP	0.66000	UGG
UB	TCL BNA	SMV1	Di-n-butyl-phthalate	DNBP	0.66000	UGG
UB	TCL BNA	SMV1	Di-n-octyl phthalate	DNOP	0.66000	UGG
UB	TCL BNA	SMV1	Fluoranthene	FANT	0.66000	UGG
UB	TCL BNA	SMV1	Fluorene	FLRENE	0.66000	UGG
UB	TCL BNA	SMV1	Hexachlorobutadiene	HCBD	0.66000	UGG
UB	TCL BNA	SMV1	Indeno(1,2,3-cd)pyrene	ICDPYR	0.66000	UGG
UB	TCL BNA	SMV1	Isophorone	ISOPHR	0.66000	UGG
UB	TCL BNA	SMV1	Naphthalene	NAP	0.66000	UGG
UB	TCL BNA	SMV1	Nitrobenzene	NB	0.66000	UGG
UB	TCL BNA	SMV1	N-nitrosodipropylamine	NNDNPA	0.66000	UGG
UB	TCL BNA	SMV1	N-nitrosodiphenylamine	NNDPA	0.66000	UGG
UB	TCL BNA	SMV1	Pentachlorophenol	PCP	0.66000	UGG
UB	TCL BNA	SMV1	Phenanthrene	PHANTR	0.66000	UGG
UB	TCL BNA	SMV1	Phenol	PHENOL	0.66000	UGG
UB	TCL BNA	SMV1	Pyrene	PYR	0.66000	UGG
UB	TCL Pest	PST1	alpha-BHC	ABHC	0.00200	UGG
UB	TCL Pest	PST1	alpha-Chlordane	ACLDAN	0.00200	UGG
UB	TCL Pest	PST1	Endosulfan,A	AENSLF	0.00200	UGG
UB	TCL Pest	PST1	Aldrin	ALDRN	0.00200	UGG
UB	TCL Pest	PST1	beta-BHC	BBHC	0.00200	UGG
UB	TCL Pest	PST1	Endosulfan,B	BENSLF	0.00200	UGG
UB	TCL Pest	PST1	delta-BHC	DBHC	0.00200	UGG
UB	TCL Pest	PST1	Dieldrin	DLDRN	0.00200	UGG
UB	TCL Pest	PST1	Endrin	ENDRN	0.00200	UGG
UB	TCL Pest	PST1	Endrin Aldehyde	ENDRNA	0.00200	UGG
UB	TCL Pest	PST1	Endosulfan Sulfate	ESFSO4	0.00200	UGG
UB	TCL Pest	PST1	gamma-Chlordane	GCLDAN	0.00200	UGG
UB	TCL Pest	PST1	Heptachlor	HPCL	0.00200	UGG
UB	TCL Pest	PST1	Heptachlor Epoxide	HPCLE	0.00200	UGG
UB	TCL Pest	PST1	Lindane	LIN	0.00200	UGG
UB	TCL Pest	PST1	Methoxychlor	MEXCLR	0.02000	UGG
UB	TCL Pest	PST1	PCB-1016	PCB016	0.02000	UGG
UB	TCL Pest	PST1	PCB-1221	PCB221	0.02000	UGG
UB	TCL Pest	PST1	PCB-1232	PCB232	0.02000	UGG
UB	TCL Pest	PST1	PCB-1242	PCB242	0.02000	UGG
UB	TCL Pest	PST1	PCB-1248	PCB248	0.02000	UGG
UB	TCL Pest	PST1	PCB-1254	PCB254	0.02000	UGG
UB	TCL Pest	PST1	PCB-1260	PCB260	0.02000	UGG
UB	TCL Pest	PST1	P,P-DDD	PPDDD	0.00200	UGG
UB	TCL Pest	PST1	P,P-DDE	PPDDE	0.00200	UGG
UB	TCL Pest	PST1	P,P-DDT	PPDDT	0.00200	UGG
UB	TCL Pest	PST1	Toxaphene	TXPHEN	0.10000	UGG

Table F-2

Method Blank Hits

Test	Method	Lab	Lot	No	Analyte	Value	Units	FLAG
EXPLOSIVES	EXL1	EL	AATE	001	4-Amino-2,6-dinitrotoluene	0.30300	UGL	J
TAL METAL	ICP1	EL	AAOQ	001	Sodium	496.00000	UGL	J
TAL METAL	ICP1	EL	AAOQ	001	Zinc	6.28000	UGL	J
TAL METAL	ICP1	EL	AAVY	001	Aluminum	50.60000	UGL	
TAL METAL	ICP1	EL	AAVY	001	Zinc	3.34000	UGL	J
TAL METAL	ICP1	EL	AAVZ	001	Beryllium	0.12700	UGL	J
TAL METAL	ICP1	EL	AAVZ	001	Sodium	255.00000	UGL	J
TAL METAL	ICP1	EL	AAVZ	001	Zinc	8.02000	UGL	J
TAL METAL	ICP1	EL	AAWA	001	Aluminum	16.80000	UGL	J
TAL METAL	ICP1	EL	AAWA	001	Zinc	10.40000	UGL	J
TAL METAL	ICP1	EL	ABEL	001	Potassium	317.00000	UGL	J
TAL METAL	ICP1	EL	ABEL	001	Zinc	5.90000	UGL	J
TAL METAL	ICP1	EL	ABGT	001	Potassium	905.00000	UGL	J
TAL METAL	ICP1	EL	ABGT	001	Sodium	1190.00000	UGL	J
TAL METAL	GPB1	EL	ABHV	001	Lead	0.68000	UGL	J
TAL METAL	GPB1	EL	ABIC	001	Lead	0.79000	UGL	J
TCL BNA	SMV1	EL	AAKM	002	C35	0.18000	UGG	
TCL BNA	SMV1	EL	AAMN	001	Di-n-butyl-phthalate	0.08200	UGG	J
TCL BNA	SMV1	EL	AAMN	002	Di-n-butyl-phthalate	0.09200	UGG	J
TCL BNA	SMV1	EL	AANC	002	C36	0.12000	UGG	
TCL BNA	SMV1	EL	AAND	002	LINOLA	16.00000	UGL	
TCL BNA	SMV1	EL	AANO	001	LINOLA	0.12000	UGG	
TCL BNA	SMV1	EL	AANP	002	2,4,6-Tribromophenyl	0.96000	UGG	
TCL BNA	SMV1	EL	AANP	001	LINOLA	0.10000	UGG	
TCL BNA	SMV1	EL	AASH	001	Bis(2-ethylhexyl)phthalate	0.04700	UGG	J
TCL BNA	SMV1	EL	AASH	002	Bis(2-ethylhexyl)phthalate	0.05500	UGG	J
TCL BNA	SMV1	EL	AASH	001	Butyl benzyl phthalate	0.05900	UGG	J
TCL BNA	SMV1	EL	AASH	002	Butyl benzyl phthalate	0.07300	UGG	J
TCL BNA	SMV1	EL	AASH	001	Di-n-butyl-phthalate	0.20000	UGG	J
TCL BNA	SMV1	EL	AASH	002	Di-n-butyl-phthalate	0.16000	UGG	J
TCL BNA	SMV1	EL	AASI	001	Diethyl phthalate	0.06500	UGG	J
TCL BNA	SMV1	EL	AASI	002	Diethyl phthalate	0.05200	UGG	J
TCL BNA	SMV1	EL	AASP	001	LINOLA	0.29000	UGG	
TCL BNA	SMV1	EL	AASS	002	Di-n-butyl-phthalate	0.09700	UGG	J
TCL BNA	SMV1	EL	AASY	001	Bis(2-ethylhexyl)phthalate	0.21000	UGG	J
TCL BNA	SMV1	EL	AASZ	001	Bis(2-chloroisopropyl) ether	0.08600	UGG	J
TCL BNA	SMV1	EL	AASZ	002	Di-n-butyl-phthalate	0.06100	UGG	J
TCL BNA	SMV1	EL	AATO	001	Bis(2-ethylhexyl)phthalate	0.05000	UGG	J
TCL BNA	SMV1	EL	AATO	002	Bis(2-ethylhexyl)phthalate	0.08300	UGG	J
TCL BNA	SMV1	EL	AATO	002	Di-n-butyl-phthalate	0.03800	UGG	J
TCL BNA	SMV1	EL	AATR	002	C36	0.20000	UGG	
TCL BNA	SMV1	EL	AAYN	001	Bis(2-ethylhexyl)phthalate	0.05800	UGG	J
TCL BNA	SMV1	EL	AAYN	002	Bis(2-ethylhexyl)phthalate	0.05900	UGG	J

Table F-2

Method Blank Hits

Test	Method	Lab	Lot	No	Analyte	Value	Units	FLAG
TCL BNA	SMV1	EL	AAYO	001	Bis(2-ethylhexyl)phthalate	0.06000	UGG	J
TCL BNA	SMV1	EL	AAYO	002	Bis(2-ethylhexyl)phthalate	0.06800	UGG	J
TCL BNA	SMV1	EL	AAYP	001	Bis(2-ethylhexyl)phthalate	0.09500	UGG	J
TCL BNA	SMV1	EL	AAYP	002	Bis(2-ethylhexyl)phthalate	0.06000	UGG	J
TCL BNA	SMV1	EL	AAYZ	001	Bis(2-ethylhexyl)phthalate	0.09700	UGG	J
TCL BNA	SMV1	EL	AAYZ	002	Bis(2-ethylhexyl)phthalate	0.09800	UGG	J
TCL BNA	SMV1	EL	ABFN	002	Benzo(a)anthracene	13.00000	UGL	
TCL BNA	SMV1	EL	ABFN	002	Benzo(a)pyrene	15.00000	UGL	
TCL BNA	SMV1	EL	ABFN	002	Benzo(b)fluoranthene	17.00000	UGL	
TCL BNA	SMV1	EL	ABFN	002	Benzo(ghi)perylene	11.00000	UGL	
TCL BNA	SMV1	EL	ABFN	002	Benzo(k)fluoranthene	4.90000	UGL	J
TCL BNA	SMV1	EL	ABFN	002	Chrysene	11.00000	UGL	
TCL BNA	SMV1	EL	ABFN	002	Dibenzo(a,h)anthracene	2.30000	UGL	J
TCL BNA	SMV1	EL	ABFN	002	Fluoranthene	17.00000	UGL	
TCL BNA	SMV1	EL	ABFN	002	Indeno(1,2,3-cd)pyrene	11.00000	UGL	
TCL BNA	SMV1	EL	ABFN	002	Phenanthrene	11.00000	UGL	
TCL BNA	SMV1	EL	ABFN	002	Pyrene	15.00000	UGL	
TCL BNA	SMV1	EL	ABGM	002	Bis(2-ethylhexyl)phthalate	11.00000	UGL	
TCL Pest	PST1	EL	AAKW	001	Endosulfan,A	0.00300	UGG	U
TCL Pest	PST1	EL	AANU	001	Endosulfan,A	0.00100	UGG	U
TCL Pest	PST1	EL	AASO	001	Heptachlor	0.04900	UGL	U
TCL Pest	PST1	EL	AAYU	001	Endosulfan,A	0.02900	UGL	U
TCL Pest	PST1	UB	AEHH	001	Endosulfan,A	0.00032	UGG	J
TCL Pest	PST1	UB	AEHH	001	Dieldrin	0.00200	UGG	J
TCL Pest	PST1	UB	AEHH	001	Endosulfan Sulfate	0.00100	UGG	J
TCL Pest	PST1	UB	AEHH	001	P,P-DDE	0.00100	UGG	J
TCL Pest	PST1	UB	AEHH	001	P,P-DDT	0.00100	UGG	J
TCL Pest	PST1	UB	AEIB	001	Endosulfan,A	0.00100	UGG	J
TCL Pest	PST1	UB	AEIB	001	Dieldrin	0.00100	UGG	J
TCL Pest	PST1	UB	AEIB	001	Endrin	0.00100	UGG	J
TCL Pest	PST1	UB	AEIB	001	Endrin Aldehyde	0.00100	UGG	J
TCL Pest	PST1	UB	AEIB	001	Endosulfan Sulfate	0.00400	UGG	
TCL Pest	PST1	UB	AEIB	001	Heptachlor Epoxide	0.00100	UGG	J
TCL Pest	PST1	UB	AEIB	001	P,P-DDT	0.00100	UGG	J
TCL Pest	PST1	UB	AEKG	001	alpha-BHC	0.00100	UGG	J
TCL Pest	PST1	UB	AEKG	001	Endosulfan,A	0.00036	UGG	J
TCL Pest	PST1	UB	AEKG	001	Lindane	0.00100	UGG	J
TCL Pest	PST1	UB	AEPJ	001	alpha-BHC	0.00039	UGG	J
TCL Pest	PST1	UB	AEPJ	001	Endosulfan,A	0.00039	UGG	J
TCL Pest	PST1	UB	AEQE	001	Endosulfan,A	0.00025	UGG	J
TCL Pest	PST1	UB	AEQE	001	Aldrin	0.00045	UGG	J
TCL Pest	PST1	UB	AEQE	001	Endrin	0.00100	UGG	J
TCL Pest	PST1	UB	AEQE	001	Endosulfan Sulfate	0.00100	UGG	J

Table F-2

Method Blank Hits

Test	Method	Lab	Lot	No	Analyte	Value	Units	FLAG
TCL Pest	PST1	UB	AEQE	001	Lindane	0.00100	UGG	J
TCL Pest	PST1	UB	AEUC	001	alpha-BHC	0.00043	UGG	J
TCL Pest	PST1	UB	AEUC	001	Endosulfan,B	0.00200	UGG	J
TCL Pest	PST1	UB	AEUC	001	Dieldrin	0.00200	UGG	
TCL Pest	PST1	UB	AEUC	001	Endrin	0.00300	UGG	
TCL Pest	PST1	UB	AEUC	001	Endosulfan Sulfate	0.00200	UGG	J
TCL Pest	PST1	UB	AEUC	001	Lindane	0.00200	UGG	J
TCL Pest	PST1	UB	AEUC	001	P,P-DDE	0.00300	UGG	
TCL Pest	PST1	UB	AEVN	001	Endosulfan,A	0.00100	UGG	J
TCL Pest	PST1	UB	AEVN	001	delta-BHC	0.00051	UGG	J
TCL Pest	PST1	UB	AEVN	001	Endrin Aldehyde	0.00200	UGG	J
TCL Pest	PST1	UB	AEVN	001	Heptachlor	0.00100	UGG	J
TCL Pest	PST1	UB	AEVN	001	Heptachlor Epoxide	0.00086	UGG	J
TCL Pest	PST1	UB	AEVN	001	P,P-DDD	0.00100	UGG	J
TCL Pest	PST1	UB	AEVN	001	P,P-DDE	0.00067	UGG	J
TCL Pest	PST1	UB	AEWV	001	alpha-BHC	0.00300	UGG	
TCL Pest	PST1	UB	AEWV	001	Endosulfan,A	0.00200	UGG	
TCL Pest	PST1	UB	AEWV	001	Aldrin	0.00300	UGG	
TCL Pest	PST1	UB	AEWV	001	delta-BHC	0.00100	UGG	J
TCL Pest	PST1	UB	AEWV	001	Dieldrin	0.00200	UGG	J
TCL Pest	PST1	UB	AEWV	001	Endrin	0.00042	UGG	J
TCL Pest	PST1	UB	AEWV	001	Endosulfan Sulfate	0.00100	UGG	J
TCL Pest	PST1	UB	AEWV	001	gamma-Chlordane	0.00100	UGG	J
TCL Pest	PST1	UB	AEWV	001	Heptachlor	0.00200	UGG	J
TCL Pest	PST1	UB	AEWV	001	Heptachlor Epoxide	0.00100	UGG	J
TCL Pest	PST1	UB	AEWV	001	Lindane	0.00200	UGG	
TCL Pest	PST1	UB	AEWV	001	P,P-DDD	0.00100	UGG	J
TCL Pest	PST1	UB	AEWV	001	P,P-DDE	0.00100	UGG	J
TCL Pest	PST1	UB	AEXB	001	alpha-BHC	0.00100	UGG	J
TCL Pest	PST1	UB	AEXB	001	alpha-Chlordane	0.00100	UGG	J
TCL Pest	PST1	UB	AEXB	001	Endosulfan,A	0.00100	UGG	J
TCL Pest	PST1	UB	AEXB	001	Aldrin	0.00044	UGG	J
TCL Pest	PST1	UB	AEXB	001	Dieldrin	0.00100	UGG	J
TCL Pest	PST1	UB	AEXB	001	Endosulfan Sulfate	0.00100	UGG	J
TCL Pest	PST1	UB	AEXB	001	Heptachlor	0.00100	UGG	J
TCL Pest	PST1	UB	AEXB	001	Lindane	0.00200	UGG	J
TCL Pest	PST1	UB	AEYR	001	Endosulfan,A	0.00300	UGG	
TCL Pest	PST1	UB	AEYR	001	Endosulfan,B	0.00100	UGG	J
TCL Pest	PST1	UB	AEYR	001	Dieldrin	0.00100	UGG	J
TCL Pest	PST1	UB	AEYR	001	Endrin	0.00200	UGG	J
TCL Pest	PST1	UB	AEYR	001	Endrin Aldehyde	0.00200	UGG	J
TCL Pest	PST1	UB	AEYR	001	gamma-Chlordane	0.00100	UGG	J
TCL Pest	PST1	UB	AEYR	001	Heptachlor Epoxide	0.00100	UGG	J

Table F-2

Method Blank Hits

Test	Method	Lab	Lot	No	Analyte	Value	Units	FLAG
TCL Pest	PST1	UB	AEYR	001	Lindane	0.00200	UGG	
TCL Pest	PST1	UB	AEYR	001	P,P-DDD	0.00100	UGG	J
TCL Pest	PST1	UB	AEYR	001	P,P-DDE	0.00100	UGG	J
TCL Pest	PST1	UB	AFOC	001	Aldrin	0.00100	UGG	J
TCL Pest	PST1	UB	AFOC	001	Endrin	0.00100	UGG	J
TCL Pest	PST1	UB	AFOC	001	Endosulfan Sulfate	0.00200	UGG	
TCL Pest	PST1	UB	AFOC	001	P,P-DDT	0.00100	UGG	J
TCL VOA	VMS1	EL	AAJY	001	Acetone	0.03700	UGG	J
TCL VOA	VMS1	EL	AAJY	002	Acetone	0.02400	UGG	J
TCL VOA	VMS1	EL	AAJY	001	Methylene chloride	0.02200	UGG	
TCL VOA	VMS1	EL	AAJY	002	Methylene chloride	0.01600	UGG	
TCL VOA	VMS1	EL	AAKT	001	Methylene chloride	0.03300	UGG	
TCL VOA	VMS1	EL	AAKT	002	Methylene chloride	0.03200	UGG	
TCL VOA	VMS1	EL	AALF	001	Methylene chloride	13.00000	UGL	
TCL VOA	VMS1	EL	AALF	002	Methylene chloride	17.00000	UGL	
TCL VOA	VMS1	EL	AALG	001	Methylene chloride	0.03000	UGG	
TCL VOA	VMS1	EL	AALG	002	Methylene chloride	0.05200	UGG	
TCL VOA	VMS1	EL	AALG	001	Toluene	0.00400	UGG	J
TCL VOA	VMS1	EL	AAMR	001	Acetone	0.02800	UGG	J
TCL VOA	VMS1	EL	AAMR	001	Methylene chloride	0.03200	UGG	
TCL VOA	VMS1	EL	AAMR	002	Methylene chloride	0.02900	UGG	
TCL VOA	VMS1	EL	AAMS	002	Chloroethane	4.50000	UGL	J
TCL VOA	VMS1	EL	AAMS	001	Methylene chloride	4.00000	UGL	J
TCL VOA	VMS1	EL	AAMT	001	Methylene chloride	0.02000	UGG	
TCL VOA	VMS1	EL	AAMT	002	Methylene chloride	0.01600	UGG	
TCL VOA	VMS1	EL	AANX	002	Acetone	0.02100	UGG	J
TCL VOA	VMS1	EL	AANX	001	Methylene chloride	0.02100	UGG	
TCL VOA	VMS1	EL	AANX	002	Methylene chloride	0.01400	UGG	
TCL VOA	VMS1	EL	AANY	001	Methylene chloride	0.01100	UGG	
TCL VOA	VMS1	EL	AANY	002	Methylene chloride	0.01400	UGG	
TCL VOA	VMS1	EL	AAOA	002	Acetone	0.02000	UGG	J
TCL VOA	VMS1	EL	AAOA	001	Methylene chloride	0.00700	UGG	J
TCL VOA	VMS1	EL	AAOA	002	Methylene chloride	0.02400	UGG	
TCL VOA	VMS1	EL	AAQK	001	Methylene chloride	0.00900	UGG	J
TCL VOA	VMS1	EL	AAQK	002	Methylene chloride	0.02700	UGG	
TCL VOA	VMS1	EL	AARX	001	Acetone	0.02100	UGG	J
TCL VOA	VMS1	EL	AARX	001	Methylene chloride	0.03200	UGG	
TCL VOA	VMS1	EL	AARX	002	Methylene chloride	0.03000	UGG	
TCL VOA	VMS1	EL	AARY	002	12DMB	0.00200	UGG	J
TCL VOA	VMS1	EL	AARY	002	134DMB	0.00600	UGG	
TCL VOA	VMS1	EL	AARY	001	Acetone	0.05900	UGG	J
TCL VOA	VMS1	EL	AARY	002	Acetone	0.08400	UGG	J
TCL VOA	VMS1	EL	AARY	001	Methylene chloride	0.00900	UGG	J

Table F-2 Method Blank Hits								
Test	Method	Lab	Lot	No	Analyte	Value	Units	FLAG
TCL VOA	VMS1	EL	AARY	002	Methylene chloride	0.01200	UGG	
TCL VOA	VMS1	EL	AARY	001	Toluene	0.00400	UGG	J
TCL VOA	VMS1	EL	AARY	002	Toluene	0.00800	UGG	
TCL VOA	VMS1	EL	AARY	001	2-Butanone	0.01100	UGG	
TCL VOA	VMS1	EL	AARY	002	2-Butanone	0.01700	UGG	
TCL VOA	VMS1	EL	AASA	001	Methylene chloride	6.50000	UGL	
TCL VOA	VMS1	EL	AASA	002	Methylene chloride	4.80000	UGL	J
TCL VOA	VMS1	EL	AASN	001	Methylene chloride	5.40000	UGL	
TCL VOA	VMS1	EL	AASN	002	Methylene chloride	6.00000	UGL	
TCL VOA	VMS1	EL	AASQ	001	Acetone	0.02600	UGG	J
TCL VOA	VMS1	EL	AASQ	001	Methylene chloride	0.04300	UGG	
TCL VOA	VMS1	EL	AASQ	002	Methylene chloride	0.06000	UGG	
TCL VOA	VMS1	EL	AASQ	001	Toluene	0.00300	UGG	J
TCL VOA	VMS1	EL	AATG	001	Methylene chloride	4.10000	UGL	J
TCL VOA	VMS1	EL	AATG	002	Methylene chloride	4.20000	UGL	J
TCL VOA	VMS1	EL	AATH	001	Methylene chloride	0.01100	UGG	
TCL VOA	VMS1	EL	AATH	002	Methylene chloride	0.01100	UGG	
TCL VOA	VMS1	EL	AATI	001	Acetone	0.04300	UGG	J
TCL VOA	VMS1	EL	AATI	002	Acetone	0.02200	UGG	J
TCL VOA	VMS1	EL	AATI	001	Methylene chloride	0.02500	UGG	
TCL VOA	VMS1	EL	AATI	002	Methylene chloride	0.00500	UGG	J
TCL VOA	VMS1	EL	AATL	001	Methylene chloride	4.30000	UGL	J
TCL VOA	VMS1	EL	AATL	002	Methylene chloride	4.00000	UGL	J
TCL VOA	VMS1	EL	AATV	001	Methylene chloride	5.10000	UGL	
TCL VOA	VMS1	EL	AATV	002	Methylene chloride	3.90000	UGL	J
TCL VOA	VMS1	EL	AATX	001	Methylene chloride	3.60000	UGL	J
TCL VOA	VMS1	EL	AAXY	001	Acetone	0.10000	UGG	
TCL VOA	VMS1	EL	AAXY	002	Acetone	0.12000	UGG	
TCL VOA	VMS1	EL	AAXY	001	Methylene chloride	0.01200	UGG	
TCL VOA	VMS1	EL	AAXY	002	Methylene chloride	0.00500	UGG	J
TCL VOA	VMS1	EL	AAXZ	001	Acetone	0.12000	UGG	
TCL VOA	VMS1	EL	AAXZ	002	Acetone	0.09200	UGG	J
TCL VOA	VMS1	EL	AAXZ	001	Toluene	0.00500	UGG	J
TCL VOA	VMS1	EL	AAXZ	002	Toluene	0.00300	UGG	J
TCL VOA	VMS1	EL	AAXZ	001	2-Butanone	0.01400	UGG	
TCL VOA	VMS1	EL	AAXZ	002	2-Butanone	0.01000	UGG	
TCL VOA	VMS1	EL	AAYB	001	Methylene chloride	3.90000	UGL	J
TCL VOA	VMS1	EL	AAYB	002	Methylene chloride	4.20000	UGL	J
TCL VOA	VMS1	EL	AAYM	001	Acetone	0.08800	UGG	J
TCL VOA	VMS1	EL	AAYM	002	Acetone	0.06800	UGG	J
TCL VOA	VMS1	EL	AAYM	001	Methylene chloride	0.01600	UGG	
TCL VOA	VMS1	EL	AAYM	002	Methylene chloride	0.01600	UGG	
TCL VOA	VMS1	EL	AAYM	001	2-Butanone	0.01000	UGG	

Table F-2								
Method Blank Hits								
Test	Method	Lab	Lot	No	Analyte	Value	Units	FLAG
TCL VOA	VMS1	EL	AAZI	001	Methylene chloride	0.00500	UGG	J
TCL VOA	VMS1	EL	AAZJ	001	Acetone	0.01800	UGG	J
TCL VOA	VMS1	EL	AAZJ	002	Acetone	0.04400	UGG	J
TCL VOA	VMS1	EL	AAZJ	001	Methylene chloride	0.00900	UGG	J
TCL VOA	VMS1	EL	AAZJ	002	Methylene chloride	0.00700	UGG	J
TCL VOA	VMS1	EL	AAZK	001	Acetone	0.01900	UGG	J
TCL VOA	VMS1	EL	AAZK	002	Acetone	0.03300	UGG	J
TCL VOA	VMS1	EL	AAZK	002	Methylene chloride	0.00500	UGG	J
TCL VOA	VMS1	EL	ABAG	001	Methylene chloride	0.00700	UGG	J
TCL VOA	VMS1	EL	ABAG	002	Methylene chloride	0.00800	UGG	J
TCL VOA	VMS1	EL	ABAH	001	Acetone	0.15000	UGG	
TCL VOA	VMS1	EL	ABAH	002	Acetone	0.09800	UGG	J
TCL VOA	VMS1	EL	ABAH	001	2-Butanone	0.00900	UGG	J
TCL VOA	VMS1	EL	ABAI	001	Methylene chloride	5.10000	UGL	
TCL VOA	VMS1	EL	ABAI	002	Methylene chloride	6.10000	UGL	
TCL VOA	VMS1	EL	ABAI	001	Carbon disulfide	4.80000	UGL	J
TCL VOA	VMS1	EL	ABAI	002	Carbon disulfide	6.20000	UGL	
TCL VOA	VMS1	EL	ABBE	001	Methylene chloride	3.90000	UGL	J
TCL VOA	VMS1	EL	ABBE	002	Methylene chloride	3.80000	UGL	J
TCL VOA	VMS1	EL	ABBF	001	Acetone	0.08700	UGG	J
TCL VOA	VMS1	EL	ABBF	002	Acetone	0.02100	UGG	J
TCL VOA	VMS1	EL	ABGX	001	Methylene chloride	7.80000	UGL	
TCL VOA	VMS1	EL	ABGX	002	Methylene chloride	7.00000	UGL	
TCL VOA	VMS1	EL	ABGY	001	Methylene chloride	11.00000	UGL	
TCL VOA	VMS1	EL	ABGY	002	Methylene chloride	10.00000	UGL	
TCL VOA	VMS1	EL	ABGZ	001	Methylene chloride	4.70000	UGL	J
TCL VOA	VMS1	EL	ABGZ	002	Methylene chloride	4.10000	UGL	J
TCL VOA	VMS1	EL	ABHA	001	Methylene chloride	6.30000	UGL	
TCL VOA	VMS1	EL	ABHA	002	Methylene chloride	7.90000	UGL	
TCL VOA	VMS1	EL	ABHB	001	Acetone	0.06200	UGG	J
TCL VOA	VMS1	EL	ABHB	002	Acetone	0.04400	UGG	J
TCL VOA	VMS1	EL	ABHB	001	Methylene chloride	0.00400	UGG	J
TCL VOA	VMS1	EL	ABHB	002	Methylene chloride	0.00300	UGG	J
TCL VOA	VMS1	EL	ABJN	001	Methylene chloride	12.00000	UGL	
TCL VOA	VMS1	EL	ABJN	002	Methylene chloride	19.00000	UGL	
TCL VOA	VMS1	EL	ABJN	001	Chloroform	3.60000	UGL	J

File Type: CSO
Site Type: AREA

Table: F-3

Chemical Summary Report For Surficial Soils
Units: UGL

	Site ID	E3-P42-S01					
	Field Sample ID	SR4201X1					
	Sample Date	08/03/93					
Test	Parameter .						
TAL METAL	Sodium	275 BJ					
	Zinc	5.16 BJ					
TCL BNA	Di-n-butyl-phthalate	14.0					
TCL VOA	Acetone	15.0					
	Methylene chloride	4.80 J					

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

File Type: CSE
Site Type: POND

Table: F-3

Chemical Summary Report For Sediments
Units: UGL

	Site ID	E3-BCK-D02	E3-P13-D01	E3-P26-D01	E3-PUF-D03		
	Field Sample ID	DRBCK021	DRP13012	DR2601X1	DRPUF011		
	Sample Date	09/22/93	12/01/93	08/04/93	11/05/93		
Test	Parameter .						
TAL METAL	Antimony	< 5.00		< 5.00	1.36 J		
	Cadmium	< 5.00		< 5.00	2.67 J		
	Potassium	< 1000		584 J	< 1000		
	Zinc	3.92 J		< 20.0	2.36 BJ		
TCL BNA	Di-n-butyl-phthalate	< 10.0		15.0			
TCL Pest	Heptachlor	0.459 U		< 0.040	< 0.040		
TCL VOA	1,1,1-Trichloroethane	< 5.00		3.50 BJ			
	Acetone	< 10.0		25.0 B			
	Carbon disulfide	6.40 B		< 5.00			
	Chloroform	6.20		< 5.00			
	Methylene chloride	15.0 B		15.0 B			

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

File Type: CSO
Site Type: EXCV

Table: F-3

Chemical Summary Report For Excavations
Units: UGL

Test	Parameter	E3-A08-P01	E3-A11-P02	E3-P31-B01	E3-P56-B01		
	Field Sample ID	ERA08011	ERA11011	ERP31011	ERP56011		
	Sample Date	09/22/93	09/23/93	09/24/93	09/20/93		
TAL METAL	Aluminum	< 25.0	< 25.0	< 25.0	24.2 J		
	Iron	< 25.0	41.4	15.6 J	15.2 J		
	Zinc	11.8 J	24.9	7.88 J	1.43 J		
TCL BNA	Di-n-butyl-phthalate	< 10.0	< 12.0	< 10.0	8.00 J		
TCL Pest	Heptachlor	< 0.040	0.260 U	< 0.040	< 0.040		
	Heptachlor Epoxide	< 0.040	< 0.048	0.240 U	< 0.040		
TCL VOA	Carbon disulfide	< 5.00	< 5.00	2.50 J	< 5.00		
	Chloroform	1.80 J	4.20 J	3.50 J	< 5.00		
	Methylene chloride	9.70 B	10.0 B	7.70 B	4.30 BJ		
WQP	Phosphorus, Total	32.0					

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

File Type: CSO
Site Type: BORE

Table: F-3

Chemical Summary Report For Subsurface Soils
Units: UGL

Test	Parameter	E3-A12-B01	E3-P01-B01	E3-P01-B04	E3-P02-B01	E3-P28-B01	E3-P36-B01
	Field Sample ID	BR1201X1	BR0101X1	BRP01042	BR0201X1	BR2801X1	BR3601X1
	Sample Date	08/10/93	08/11/93	12/01/93	08/11/93	08/09/93	08/05/93
	Depth	0.0 ft.	0.0 ft.	0.0 ft.	0.0 ft.	0.0 ft.	0.0 ft.
TAL METAL	Aluminum			86.3	45.3	< 25.0	11.7 J
	Arsenic			1.28 J	< 2.00	< 2.00	< 2.00
	Copper			3.53 J	< 10.0	< 10.0	< 10.0
	Iron			410	< 25.0	< 25.0	< 25.0
	Lead			0.700 BJ	< 5.00	< 5.00	< 5.00
	Manganese			3.26 J	< 5.00	< 5.00	< 5.00
	Potassium			< 1000	< 1000	< 1000	560 J
	Sodium			1010 BJ	264 BJ	< 2000	< 2000
	Zinc			11.4 J	< 20.0	6.03 BJ	4.97 BJ
TCL BNA	Bis(2-ethylhexyl)phthalate			< 10.0	< 10.0	< 10.0	11.0
	Di-n-butyl-phthalate			< 10.0	< 10.0	< 10.0	11.0
	HEDODA					13.0	
	LINOLA					16.0 B	
TCL VOA	1,1,1-Trichloroethane		< 5.00		< 5.00	< 5.00	< 5.00
	Acetone		< 10.0		< 10.0	< 10.0	16.0
	Methylene chloride		3.40 J		3.30 J	3.20 BJ	15.0 B

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

File Type: CSO
Site Type: BORE

Table: F-3

Chemical Summary Report For Subsurface Soils
Units: UGL

Test	Parameter	E3-P37-B02	E3-P38-B04	E3-P48-B01			
	Field Sample ID	BR3701X1	BR3801X1	BR4801X1			
	Sample Date	08/09/93	08/10/93	08/10/93			
	Depth	0.0 ft.	0.0 ft.	0.0 ft.			
TAL METAL	Aluminum	< 25.0	16.6 J				
	Arsenic	< 2.00	2.67				
	Copper	< 10.0	< 10.0				
	Iron	86.0	18.7 J				
	Lead	< 5.00	17.2				
	Manganese	0.816 J	< 5.00				
	Potassium	549 J	< 1000				
	Sodium	< 2000	< 2000				
	Zinc	11.3 BJ	< 20.0				
TCL BNA	Bis(2-ethylhexyl)phthalate	< 10.0	< 10.0				
	Di-n-butyl-phthalate	< 10.0	< 10.0				
	HEDODA						
	LINOLA						
TCL VOA	1,1,1-Trichloroethane	< 5.00	< 5.00	3.30 BJ			
	Acetone	12.0	< 10.0	< 20.0			
	Methylene chloride	3.90 BJ	3.00 BJ	< 5.00			

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

Table: F-3

File Type: CGW
Site Type: WELL

Chemical Summary Report For Groundwater
Units: UGL

	Site ID	E3-P11-M01	E3-P11-M01	E3-P31-M01	E3-P36-M01	E3-P37-M02	E3-P58-M01
	Field Sample ID	MR1101X1	MRP11012	MRP31012	MRP36012	MRP37021	MRP58011
	Sample Date	08/24/93	11/30/93	12/03/93	12/01/93	09/02/93	09/02/93
Test	Parameter .						
EXPLOSIVES	1,3,5-Trinitrobenzene			0.231 JC			0.186 J
	1,3-Dinitrobenzene			0.567 JC			0.580 J
	2-Nitrotoluene			1.06 C			< 1.00
	3-Nitrotoluene			1.06 C			0.997 J
	4-Amino-2,6-dinitrotoluene			0.210 JC			< 1.00
TAL METAL	Aluminum	< 25.0	< 25.0		< 25.0	15.6 BJ	10.7 BJ
	Antimony	< 5.00	< 5.00		< 5.00	< 5.00	< 5.00
	Beryllium	< 5.00	< 5.00		< 5.00	< 5.00	< 5.00
	Calcium	< 500	< 500		< 500	< 500	< 500
	Iron	< 25.0	10.1 J		15.9 J	26.6 K	< 25.0
	Lead	< 5.00	< 5.00		< 5.00	< 5.00	< 5.00
	Magnesium	< 500	< 500		< 500	< 500	< 500
	Manganese	< 5.00	0.853 J		< 5.00	< 5.00	1.45 J
	Silver	< 2.00 L	< 2.00		< 2.00	< 2.00	2.20
	Sodium	< 2000	< 2000		909 BJ	< 2000	< 2000
	Zinc	< 20.0	3.16 J		< 20.0	12.1 BJ	10.4 BJ
TCL BNA	Di-n-butyl-phthalate		< 10.0	12.0	< 10.0	< 12.0	< 10.0
TCL Pest	Heptachlor	< 0.020	< 0.020	< 0.020	0.223 U	< 0.091	0.090 U
	Lindane	< 0.020	< 0.020	< 0.020	< 0.020	< 0.091	0.022 U
	P,P-DDT	< 0.040	< 0.040	< 0.040	< 0.040	< 0.180	0.043 U
TCL VOA	Acetone	< 10.0	< 10.0	19.0	< 10.0	< 10.0	< 10.0
	Carbon disulfide	< 5.00	< 5.00	< 5.00	4.10 J	4.10 J	< 5.00
	Chloroform	5.90	< 5.00	< 5.00	18.0	< 5.00	< 5.00
	Methylene chloride	< 5.00	9.40 B	6.60 B	< 5.00	< 5.00	< 5.00
TPHC	Total Petroleum Hydrocarbons	< 2000	250 J	< 2000	227 J	< 2000	< 2000

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

File Type: CGW
Site Type: WELL

Table: F-3

Chemical Summary Report For Filtered Groundwater
Units: UGL

	Site ID	E3-P11-M01	E3-P13-M01	E3-P36-M01	E3-P37-M02	E3-P58-M01	
	Field Sample ID	MR1101F1	MJP11012	MJP36012	MJP37021	MJP58011	
	Sample Date	08/24/93	11/30/93	12/01/93	09/02/93	09/02/93	
Test	Parameter .						
EXPLOSIVES	1,3,5-Trinitrobenzene						
	1,3-Dinitrobenzene						
	2-Nitrotoluene						
	3-Nitrotoluene						
	4-Amino-2,6-dinitrotoluene						
TAL METAL	Aluminum	31.6 B	< 25.0	24.0 J	16.0 BJ	22.8 BJ	
	Antimony	9.45	6.53	4.38 J	8.36	9.30	
	Beryllium	0.096 J	< 5.00	< 5.00	< 5.00	< 5.00	
	Calcium	< 500	< 500	< 500	160 J	< 500	
	Iron	32.8	27.6	120	39.4 K	< 25.0	
	Lead	< 5.00	< 5.00	< 5.00	1.26 J	< 5.00	
	Magnesium	< 500	< 500	< 500	31.7 J	< 500	
	Manganese	1.86 J	2.50 J	< 5.00	1.70 J	1.42 J	
	Silver	< 2.00 L	< 2.00	< 2.00	< 2.00	< 2.00	
	Sodium	< 2000	< 2000	1040 BJ	< 2000	< 2000	
	Zinc	13.1 BJ	3.80 J	3.53 J	22.6 B	5.93 BJ	
TCL BNA	Di-n-butyl-phthalate						
TCL Pest	Heptachlor						
	Lindane						
	P,P-DDT						
TCL VOA	Acetone						
	Carbon disulfide						
	Chloroform						
	Methylene chloride						
TPHC	Total Petroleum Hydrocarbons						

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

File Type: CQC
Site Type: TRIP

Table F-4

Chemical Summary Report For Trip Blanks
Units: UGL

	Site ID	E3-BCK-D04	E3-BCK-D04	E3-BCK-D08	E3-BCK-D08	E3-P02-B01	E3-P11-D01
	Field Sample ID	DVBCK021	WVBCK021	DVBCK031	WVBCK031	BV0201X1	DV1101X1
	Sample Date	09/17/93	09/17/93	09/21/93	09/21/93	08/11/93	08/03/93
Test	Parameter .						
TCL VOA	1,1,1-Trichloroethane	< 5.00	< 5.00	< 5.00	< 5.00	4.00 J	< 5.00
	Acetone	< 10.0	< 10.0	< 10.0	17.0	< 10.0	15.0
	Carbon disulfide	< 5.00	< 5.00	4.90 BJ	< 5.00	< 5.00	< 5.00
	Methylene chloride	< 5.00	< 5.00	9.50 B	6.80 B	4.00 J	6.50

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

Table F-4

File Type: CQC
Site Type: TRIP

Chemical Summary Report For Trip Blanks
Units: UGL

	Site ID	E3-P11-M01	E3-P13-D01	E3-P13-D01	E3-P13-M01	E3-P13-M01	E3-P16-S01
	Field Sample ID	MVP11012	DV1301X1	WV1301X1	MV1302X1	MVP13012	SVP16011
	Sample Date	11/30/93	08/02/93	08/02/93	08/25/93	11/29/93	09/01/93
Test	Parameter .						
TCL VOA	1,1,1-Trichloroethane	< 5.00	< 5.00	< 5.00	3.60 J	< 5.00	< 5.00
	Acetone	17.0	16.0	15.0	11.0	< 10.0	< 10.0
	Carbon disulfide	4.30 J	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
	Methylene chloride	12.0 B	5.10	5.00 J	3.50 BJ	8.20 B	3.50 BJ

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

File Type: CQC
Site Type: TRIP

Table F-4

Chemical Summary Report For Trip Blanks
Units: UGL

	Site ID	E3-P36-B01	E3-P36-B03	E3-P36-M01	E3-P36-S01	E3-P36-S07	E3-P37-B01
	Field Sample ID	BV3601X1	BV3602X1	MVP36011	SV3601X1	SV3602X1	BV3702X1
	Sample Date	08/05/93	08/13/93	09/01/93	08/25/93	08/24/93	08/09/93
Test	Parameter .						
TCL VOA	1,1,1-Trichloroethane	< 5.00	4.00 J	< 5.00	< 5.00	4.00 J	3.40 J
	Acetone	< 20.0	< 10.0	< 10.0	< 10.0	9.80 J	< 10.0
	Carbon disulfide	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
	Methylene chloride	16.0 B	4.00 J	3.10 BJ	3.50 BJ	4.40 BJ	4.60 BJ

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

File Type: CQC
Site Type: TRIP

Table F-4

Chemical Summary Report For Trip Blanks
Units: UGL

	Site ID	E3-P37-D01	E3-P37-D01	E3-P37-D02	E3-P37-M01	E3-P37-M01	E3-P37-S01
	Field Sample ID	DVP37011	WVP37011	BV3701X1	MVP37011	MVP37012	SV3701X1
	Sample Date	09/16/93	09/16/93	08/06/93	09/02/93	12/01/93	08/16/93
Test	Parameter .						
TCL VOA	1,1,1-Trichloroethane	< 5.00	< 5.00	3.20 J	< 5.00	< 5.00	4.00 J
	Acetone	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
	Carbon disulfide	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
	Methylene chloride	< 5.00	< 5.00	4.30 BJ	< 5.00	4.10 BJ	3.70 J

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

Date: 03/15/94
File Type: CSE
Site Type: POND

Table: F-5
Chemical Summary Report For Sediments
Area of Contamination: P13
Units: UGG

	Site ID	E3-P13-D01	E3-P13-D01		
	Field Sample ID	DD1301X1	DX1301X1		
	Sample Date	08/02/93	08/02/93		
Test	Parameter .			Mean	RPD
TAL METAL	Aluminum	5280	4100	4690	25.2%
	Arsenic	11.2	9.86	10.53	12.7%
	Barium	59.5	59.0	59.25	0.8%
	Beryllium	0.697	0.566	0.6315	20.7%
	Calcium	20200	19400	19800	4.0%
	Chromium	11.3	9.79	10.545	14.3%
	Cobalt	10.7	9.10	9.9	16.2%
	Copper	34.0	9.10	21.55	115.5%
	Iron	140000	13000	76500	166.0%
	Lead	72.2	69.7	70.95	3.5%
	Magnesium	2350	1980	2165	17.1%
	Manganese	66.6	76.6	71.6	14.0%
	Nickel	29.1	23.9	26.5	19.6%
	Selenium	2.65	1.94	2.295	30.9%
	Vanadium	30.9	22.9	26.9	29.7%
	Zinc	269	277	273	2.9%
TCL Pest	P,P-DDD	0.690	0.760	0.725	9.7%
	P,P-DDE	0.480	0.540	0.51	11.8%
	P,P-DDT	0.110	0.150	0.13	30.8%
TOC	Total Organic Carbon	592000	628000	610000	5.9%
TPHC	Total Petroleum Hydrocarbons	55.1	295	175.05	137.0%

Source: USAEC IRDMIS Level 3/E & E, 1994

Date: 03/15/94
File Type: CSO
Site Type: BORE

Table: F-5
Chemical Summary Report For Subsurface Soils
Area of Contamination: P37
Units: UGG

	Site ID	E3-P37-B03	E3-P37-B03		
	Field Sample ID	BD370302	BX370302		
	Sample Date	08/16/93	08/16/93		
Test	Parameter Depth	14.0 ft.	14.0 ft.	Mean	RPD
TAL METAL	Aluminum	6940	6620	6780	4.7%
	Arsenic	5.47	6.98	6.225	24.3%
	Barium	35.5	27.6	31.55	25.0%
	Beryllium	0.306	0.327	0.3165	6.6%
	Calcium	1190	975	1082.5	19.9%
	Chromium	16.0	13.6	14.8	16.2%
	Cobalt	8.02	6.74	7.38	17.3%
	Copper	9.56	8.70	9.13	9.4%
	Iron	12000	11500	11750	4.3%
	Lead	2.99 F	3.77 F	ERR	ERR
	Magnesium	2730	2550	2640	6.8%
	Manganese	151	129	140	15.7%
	Nickel	21.8	17.7	19.75	20.8%
	Potassium	1530	1460	1495	4.7%
	Vanadium	16.7	15.0	15.85	10.7%
	Zinc	41.7	35.6	38.65	15.8%
TCL BNA	Bis(2-ethylhexyl)phthalate	0.110 F	< 0.330	ERR	ERR
	Di-n-octyl phthalate	0.028	< 0.330	ERR	ERR
TOC	Total Organic Carbon	2070	3770	2920	58.2%
TPHC	Total Petroleum Hydrocarbons	< 20.0	13.2	ERR	ERR

B= Attributable to field or laboratory contamination.
C= Confirmed on second column, U= Unconfirmed.

J= Estimated value. L= Result bias low. @= Exc
K= Result bias high. R= Result rejected. != Excee

Date: 03/15/94
File Type: CSW
Site Type: POND

Table: F-5
Chemical Summary Report For Surface Waters
Area of Contamination: P11
Units: UGL

	Site ID	E3-P11-D01	E3-P11-D01		
	Field Sample ID	WDP11012	WXP11012		
	Sample Date	12/01/93	12/01/93		
Test	Parameter .			Mean	RPD
TAL METAL	Aluminum	4090	2910	3500	33.7%
	Arsenic	1.57	1.94	1.755	21.1%
	Barium	78.3	52.3	65.3	39.8%
	Beryllium	0.288	0.217	0.2525	28.1%
	Calcium	8430	7210	7820	15.6%
	Chromium	3.89	< 10.0	ERR	ERR
	Cobalt	3.10	3.18	3.14	2.5%
	Copper	10.5	7.22	8.86	37.0%
	Iron	2800	1830	2315	41.9%
	Lead	21.6	13.0	17.3	49.7%
	Magnesium	1710	1640	1675	4.2%
	Manganese	544	515	529.5	5.5%
	Vanadium	10.1	5.64	7.87	56.7%
	Zinc	82.7	65.7	74.2	22.9%
TCL BNA	2,4,6-Tribromophenyl	48.0	67.0	57.5	33.0%
	2-Fluorobiphenyl	78.0	71.0	74.5	9.4%
	2-Fluorophenol	38.0	47.0	42.5	21.2%
	Nitrobenzene - d5	67.0	65.0	66	3.0%
	PHEND5	29.0	34.0	31.5	15.9%
	Terphenyl - d14	100	98.0	99	2.0%
TCL Pest	DBUCLE	2.10	2.20	2.15	4.7%
	Isodrin	0.440	0.480	0.46	8.7%
TCL VOA	Acetone	< 10.0	12.0	ERR	ERR

B= Attributable to field or laboratory contamination.
C= Confirmed on second column, U= Unconfirmed.

J= Estimated value. L= Result bias low. @= Exc
K= Result bias high. R= Result rejected. != Excee

Date: 03/15/94
File Type: CGW
Site Type: WELL

Table: F-5
Chemical Summary Report For Groundwater
Area of Contamination: P36
Units: UGL

Test	Parameter				
	Site ID	E3-P36-M02	E3-P36-M02		
	Field Sample ID	MDP36021	MXP36021		
	Sample Date	09/02/93	09/02/93	Mean	RPD
TAL METAL	Aluminum	3450	4050	3750	16.0%
	Antimony	< 5.00	2.07	ERR	ERR
	Arsenic	2.71	3.92	3.315	36.5%
	Barium	32.5	35.4	33.95	8.5%
	Calcium	2510	2450	2480	2.4%
	Chromium	7.44	6.71	7.075	10.3%
	Cobalt	2.82	4.47	3.645	45.3%
	Copper	5.38	8.04	6.71	39.6%
	Iron	4020	5040	4530	22.5%
	Lead	3.53	< 5.00	ERR	ERR
	Magnesium	1280	1460	1370	13.1%
	Manganese	153	155	154	1.3%
	Potassium	1980	2040	2010	3.0%
	Sodium	7250	6870	7060	5.4%
	Vanadium	6.98	10.4	8.69	39.4%
	Zinc	60.7 K	24.0 BF	ERR	ERR
TCL Pest	Lindane	0.021 F	< 0.020	ERR	ERR

B= Attributable to field or laboratory contamination.
C= Confirmed on second column, U= Unconfirmed.

J= Estimated value. L= Result bias low. @= Exc
K= Result bias high. R= Result rejected. != Excee

Date: 03/15/94
File Type: CGW
Site Type: WELL

Table: F-5
Chemical Summary Report For Groundwater
Area of Contamination: P36
Units: UGL

	Site ID	E3-P36-M02	E3-P36-M02		
	Field Sample ID	MFP36021	MHP36021		
	Sample Date	09/02/93	09/02/93		
Test	Parameter .			Mean	RPD
TAL METAL	Aluminum	24.2 BF	25.9 BF	ERR	ERR
	Antimony	< 5.00	8.73 F	ERR	ERR
	Arsenic	< 2.00	< 2.00	ERR	ERR
	Barium	5.36	4.73	5.045	12.5%
	Calcium	1970	2060	2015	4.5%
	Chromium	4.00	< 10.0	ERR	ERR
	Cobalt	< 10.0	< 10.0	ERR	ERR
	Copper	< 10.0	< 10.0	ERR	ERR
	Iron	21.8 F	< 25.0	ERR	ERR
	Lead	< 5.00	< 5.00	ERR	ERR
	Magnesium	486	493	489.5	1.4%
	Manganese	106	104	105	1.9%
	Potassium	1250	1220	1235	2.4%
	Sodium	7220	7140	7180	1.1%
	Vanadium	< 10.0	3.58	ERR	ERR
	Zinc	5.75 BF	18.7 BF	ERR	ERR
TCL Pest	Lindane				

B= Attributable to field or laboratory contamination.
C= Confirmed on second column, U= Unconfirmed.

J= Estimated value. L= Result bias low. @= Exc
K= Result bias high. R= Result rejected. != Excee

Date: 03/15/94
File Type: CGW
Site Type: WELL

Table: F-5
Chemical Summary Report For Groundwater
Area of Contamination: P37
Units: UGL

	Site ID	E3-P37-M01	E3-P37-M01		
	Field Sample ID	MDP37011	MXP37011		
	Sample Date	09/02/93	09/02/93		
Test	Parameter .			Mean	RPD
TAL METAL	Aluminum	12000	11000	11500	8.7%
	Antimony	1.81	2.70	2.255	39.5%
	Arsenic	34.5	29.2	31.85	16.6%
	Barium	62.1	74.8	68.45	18.6%
	Beryllium	0.475	0.547	0.511	14.1%
	Cadmium	< 5.00	1.35	ERR	ERR
	Calcium	4960	4990	4975	0.6%
	Chromium	16.3	19.1	17.7	15.8%
	Cobalt	18.4	16.1	17.25	13.3%
	Copper	160	14.2	87.1	167.4%
	Iron	1500	14000	7750	161.3%
	Lead	6.54	5.38	5.96	19.5%
	Magnesium	3580	3450	3515	3.7%
	Manganese	408	389	398.5	4.8%
	Nickel	< 10.0	17.3	ERR	ERR
	Potassium	2610	2520	2565	3.5%
	Sodium	4100	4140	4120	1.0%
	Vanadium	22.3	21.1	21.7	5.5%
	Zinc	113 X	144	ERR	ERR
TCL Pest	Lindane	< 0.020	0.026 F	ERR	ERR
	alpha-BHC	< 0.020	0.037	ERR	ERR
TCL VOA	Carbon disulfide	< 5.00	3.00 F	ERR	ERR

B= Attributable to field or laboratory contamination.
C= Confirmed on second column, U= Unconfirmed.

J= Estimated value. L= Result bias low. @= Exc
K= Result bias high. R= Result rejected. != Excee

Date: 03/15/94
File Type: CGW
Site Type: WELL

Table: F-5
Chemical Summary Report For Groundwater
Area of Contamination: P37
Units: UGL

	Site ID	E3-P37-M01	E3-P37-M01		
	Field Sample ID	MFP37011	MHP37011		
	Sample Date	09/02/93	09/02/93		
Test	Parameter .			Mean	RPD
TAL METAL	Aluminum	15.5 BF	20.8 BF	ERR	ERR
	Antimony	< 5.00	< 5.00	ERR	ERR
	Arsenic	< 2.00	< 2.00	ERR	ERR
	Barium	8.49	6.09	7.29	32.9%
	Beryllium	< 5.00	< 5.00	ERR	ERR
	Cadmium	< 5.00	< 5.00	ERR	ERR
	Calcium	4070	4060	4065	0.2%
	Chromium	< 10.0	< 10.0	ERR	ERR
	Cobalt	< 10.0	< 10.0	ERR	ERR
	Copper	< 10.0	< 10.0	ERR	ERR
	Iron	< 25.0	< 25.0	ERR	ERR
	Lead	< 5.00	< 5.00	ERR	ERR
	Magnesium	658	720	689	9.0%
	Manganese	24.4	24.1	24.25	1.2%
	Nickel	< 10.0	< 10.0	ERR	ERR
	Potassium	647	726	686.5	11.5%
	Sodium	3780	3810	3795	0.8%
	Vanadium	< 10.0	< 10.0	ERR	ERR
	Zinc	65.7 K	78.5 K	ERR	ERR
TCL Pest	Lindane			0	ERR
	alpha-BHC			0	ERR
TCL VOA	Carbon disulfide			0	ERR

B= Attributable to field or laboratory contamination.
C= Confirmed on second column, U= Unconfirmed.

J= Estimated value. L= Result bias low. @= Exc
K= Result bias high. R= Result rejected. != Excee

Date: 03/15/94
File Type: CGW
Site Type: WELL

Table: F-5
Chemical Summary Report For Groundwater
Area of Contamination: P11
Units: UGL

	Site ID	E3-P11-M01		E3-P11-M01			
	Field Sample ID	MD1101F1		MF1101X1			
	Sample Date	08/24/93		08/24/93			
Test	Parameter .					Mean	RPD
TAL METAL	Aluminum	14.8	BF	14.7	BF	ERR	ERR
	Antimony	2.46	F	4.11	F	ERR	ERR
	Arsenic	< 2.00		< 2.00		ERR	ERR
	Barium	8.52		8.79		8.655	3.1%
	Beryllium	< 5.00		< 5.00		ERR	ERR
	Cadmium	< 5.00		< 5.00		ERR	ERR
	Calcium	6120		6140		6130	0.3%
	Chromium	5.34		< 10.0		ERR	ERR
	Cobalt	< 10.0		4.62		ERR	ERR
	Copper	< 10.0		< 10.0		ERR	ERR
	Iron	22.3	F	26.9	F	ERR	ERR
	Lead	< 5.00		< 5.00		ERR	ERR
	Magnesium	1060		1090		1075	2.8%
	Manganese	212		212		212	0.0%
	Nickel	< 10.0		< 10.0		ERR	ERR
	Potassium	3010		3080		3045	2.3%
	Sodium	3330		3370		3350	1.2%
	Vanadium	< 10.0		< 10.0		ERR	ERR
	Zinc	14.7	BF	17.9	K	ERR	ERR
TCL Pest	Endosulfan,A					0	ERR
TPHC	Total Petroleum Hydrocarbons					0	ERR

B= Attributable to field or laboratory contamination.
C= Confirmed on second column, U= Unconfirmed.

J= Estimated value. L= Result bias low. @= Exc
K= Result bias high. R= Result rejected. != Excee

Date: 03/15/94
File Type: CGW
Site Type: WELL

Table: F-5
Chemical Summary Report For Groundwater
Area of Contamination: P11
Units: UGL

Test	Parameter	E3-P11-M01	E3-P11-M01		
	Field Sample ID	MD1101X1	MX1101X1		
	Sample Date	08/24/93	08/24/93		
Test	Parameter .			Mean	RPD
TAL METAL	Aluminum	37000	31000	34000	17.6%
	Antimony	< 5.00	2.36	ERR	ERR
	Arsenic	8.49	5.91	7.2	35.8%
	Barium	177	164	170.5	7.6%
	Beryllium	1.71	1.51	1.61	12.4%
	Cadmium	4.14	2.66	3.4	43.5%
	Calcium	11500	10600	11050	8.1%
	Chromium	67.8	61.0	64.4	10.6%
	Cobalt	28.4	24.3	26.35	15.6%
	Copper	48.3	42.4	45.35	13.0%
	Iron	41000	34000	37500	18.7%
	Lead	17.1	13.8	15.45	21.4%
	Magnesium	12500	10700	11600	15.5%
	Manganese	621	556	588.5	11.0%
	Nickel	70.6	52.5	61.55	29.4%
	Potassium	10900	9770	10335	10.9%
	Sodium	4700	4410	4555	6.4%
	Vanadium	74.9	64.8	69.85	14.5%
	Zinc	120 X	99.6 X	ERR	ERR
TCL Pest	Endosulfan,A	0.024	< 0.155	ERR	ERR
TPHC	Total Petroleum Hydrocarbons	< 2000	187	ERR	ERR

B= Attributable to field or laboratory contamination.
C= Confirmed on second column, U= Unconfirmed.

J= Estimated value. L= Result bias low. @= Exc
K= Result bias high. R= Result rejected. != Excee

Table F-6 Matrix Spike Data

Study Area P13

Field no:MFP13022 Medium:CGW

Test	Lab	Lot	Analyte		Native	Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	ABFE	AS	LT	2.00000	0.00000	LT	2.00000	40.00000	47.80000	0.0	119.5	0.0
TAL METAL	EL	ABFG	AG	LT	2.00000	0.00000	LT	2.00000	40.00000	39.80000	0.0	99.5	0.0
TAL METAL	EL	ABFG	AL		120.00000	0.00000		121.00000	500.00000	660.00000	0.0	108.0	0.0
TAL METAL	EL	ABFG	BA		32.60000	0.00000		31.70000	200.00000	253.00000	0.0	110.2	0.0
TAL METAL	EL	ABFG	BE	LT	5.00000	0.00000	LT	5.00000	100.00000	105.00000	0.0	105.0	0.0
TAL METAL	EL	ABFG	CA		21500.00000	0.00000		21200.00000	10000.00000	32600.00000	0.0	111.0	0.0
TAL METAL	EL	ABFG	CD		1.65000	0.00000		2.97000	100.00000	108.00000	0.0	106.4	0.0
TAL METAL	EL	ABFG	CO	LT	10.00000	0.00000	LT	10.00000	200.00000	205.00000	0.0	102.5	0.0
TAL METAL	EL	ABFG	CR	LT	10.00000	0.00000	LT	10.00000	200.00000	216.00000	0.0	108.0	0.0
TAL METAL	EL	ABFG	CU	LT	10.00000	0.00000	LT	10.00000	200.00000	214.00000	0.0	107.0	0.0
TAL METAL	EL	ABFG	FE		127.00000	0.00000		125.00000	500.00000	670.00000	0.0	108.6	0.0
TAL METAL	EL	ABFG	K		2640.00000	0.00000		4980.00000	20000.00000	24700.00000	0.0	110.3	0.0
TAL METAL	EL	ABFG	MG		1850.00000	0.00000		1830.00000	10000.00000	12600.00000	0.0	107.5	0.0
TAL METAL	EL	ABFG	MN		47.00000	0.00000		46.20000	100.00000	151.00000	0.0	104.0	0.0
TAL METAL	EL	ABFG	NA		43500.00000	0.00000		43900.00000	40000.00000	85400.00000	0.0	104.8	0.0
TAL METAL	EL	ABFG	NI	LT	10.00000	0.00000	LT	10.00000	200.00000	198.00000	0.0	99.0	0.0
TAL METAL	EL	ABFG	V	LT	10.00000	0.00000	LT	10.00000	200.00000	220.00000	0.0	110.0	0.0
TAL METAL	EL	ABFG	ZN		18.80000	0.00000		12.80000	400.00000	421.00000	0.0	100.6	0.0
TAL METAL	EL	ABFJ	HG	LT	0.20000	0.00000		0.00000	4.00000	3.17000	0.0	79.3	0.0
TAL METAL	EL	ABHV	PB	LT	5.00000	0.00000	LT	5.00000	80.00000	87.10000	0.0	108.9	0.0
TAL METAL	EL	ABHW	SB		6.85000	0.00000		5.81000	80.00000	87.90000	0.0	101.3	0.0
TAL METAL	EL	ABHX	SE	LT	2.00000	0.00000	LT	2.00000	40.00000	36.80000	0.0	92.0	0.0
TAL METAL	EL	ABHY	TL	LT	2.00000	0.00000	LT	2.00000	40.00000	42.60000	0.0	106.5	0.0

Field no:MX1301X1 Medium:CGW

Test	Lab	Lot	Analyte		Native	Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	AAVY	AG	LT	2.00000	0.00000	LT	2.00000	40.00000	39.00000	0.0	97.5	0.0
TAL METAL	EL	AAVY	AL		32000.00000	0.00000		30700.00000	500.00000	34000.00000	0.0	400.0	0.0
TAL METAL	EL	AAVY	BA		196.00000	0.00000		198.00000	200.00000	404.00000	0.0	104.0	0.0
TAL METAL	EL	AAVY	BE		1.52000	0.00000		1.56000	100.00000	102.00000	0.0	100.5	0.0
TAL METAL	EL	AAVY	CA		20700.00000	0.00000		20300.00000	10000.00000	30900.00000	0.0	102.0	0.0
TAL METAL	EL	AAVY	CD		2.85000	0.00000		3.45000	100.00000	103.00000	0.0	100.2	0.0
TAL METAL	EL	AAVY	CO		25.00000	0.00000		22.50000	200.00000	220.00000	0.0	97.5	0.0
TAL METAL	EL	AAVY	CR		58.90000	0.00000		51.90000	200.00000	256.00000	0.0	98.6	0.0
TAL METAL	EL	AAVY	CU		38.90000	0.00000		39.50000	200.00000	230.00000	0.0	95.6	0.0

Table F-6 Matrix Spike Data

Study Area P13

Field no:MX1301X1 Medium:CGW

Test	Lab	Lot	Analyte		Native	Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	AAVY	FE		38000.00000	0.00000		36000.00000	500.00000	29500.00000	0.0	-1700.0	0.0
TAL METAL	EL	AAVY	K		9520.00000	0.00000		9470.00000	20000.00000	29100.00000	0.0	97.9	0.0
TAL METAL	EL	AAVY	MG		14200.00000	0.00000		14100.00000	10000.00000	24800.00000	0.0	106.0	0.0
TAL METAL	EL	AAVY	MN		515.00000	0.00000		511.00000	100.00000	628.00000	0.0	113.0	0.0
TAL METAL	EL	AAVY	NA		23700.00000	0.00000		23500.00000	40000.00000	61800.00000	0.0	95.3	0.0
TAL METAL	EL	AAVY	NI		44.00000	0.00000		48.40000	200.00000	243.00000	0.0	99.5	0.0
TAL METAL	EL	AAVY	V		60.00000	0.00000		59.60000	200.00000	273.00000	0.0	106.5	0.0
TAL METAL	EL	AAVY	ZN		104.00000	0.00000		109.00000	400.00000	510.00000	0.0	101.5	0.0
TAL METAL	EL	AAWE	HG	LT	0.20000	0.00000	LT	0.20000	4.00000	3.16000	0.0	79.0	0.0
TCL Pest	EL	AASO	AENSLF	LT	0.08000	0.40000		0.52000	0.40000	0.44000	130.0	110.0	16.7
TCL Pest	EL	AASO	ALDRN	LT	0.08000	0.40000		0.40000	0.40000	0.40000	100.0	100.0	0.0
TCL Pest	EL	AASO	DLDRN	LT	0.16000	0.80000		0.76000	0.80000	0.80000	95.0	100.0	5.1
TCL Pest	EL	AASO	ENDRN	LT	0.16000	0.80000		0.72000	0.80000	0.96000	90.0	120.0	28.6
TCL Pest	EL	AASO	HPCL	LT	0.08000	0.40000		0.40000	0.40000	0.40000	100.0	100.0	0.0
TCL Pest	EL	AASO	LIN	LT	0.08000	0.40000		0.40000	0.40000	0.40000	100.0	100.0	0.0
TCL Pest	EL	AASO	MEXCLR	LT	0.80000	4.00000		4.40000	4.00000	4.40000	110.0	110.0	0.0
TCL Pest	EL	AASO	PPDDT	LT	0.16000	0.80000		0.88000	0.80000	0.84000	110.0	105.0	4.7
TCL VOA	EL	AASN	11DCE	LT	5.00000	50.00000		65.00000	50.00000	67.00000	130.0	134.0	3.0
TCL VOA	EL	AASN	C6H6	LT	5.00000	50.00000		55.00000	50.00000	58.00000	110.0	116.0	5.3
TCL VOA	EL	AASN	CLC6H5	LT	5.00000	50.00000		54.00000	50.00000	55.00000	108.0	110.0	1.8
TCL VOA	EL	AASN	MEC6H5	LT	5.00000	50.00000		56.00000	50.00000	57.00000	112.0	114.0	1.8
TCL VOA	EL	AASN	TRCLE	LT	5.00000	50.00000		57.00000	50.00000	55.00000	114.0	110.0	3.6
TPHC	EL	AAXN	TPHC	LT	2000.00000	0.00000		535.00000	34300.00000	33500.00000	0.0	97.7	0.0

Field no:MXP13022 Medium:CGW

Test	Lab	Lot	Analyte		Native	Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	ABFE	AS		5.18000	0.00000		4.62000	40.00000	46.20000	0.0	102.6	0.0
TAL METAL	EL	ABFG	AG	LT	2.00000	0.00000	LT	2.00000	40.00000	37.20000	0.0	93.0	0.0
TAL METAL	EL	ABFG	AL		5800.00000	0.00000		4820.00000	500.00000	6370.00000	0.0	114.0	0.0
TAL METAL	EL	ABFG	BA		60.80000	0.00000		56.40000	200.00000	270.00000	0.0	104.6	0.0
TAL METAL	EL	ABFG	BE	LT	5.00000	0.00000	LT	5.00000	100.00000	101.00000	0.0	101.0	0.0
TAL METAL	EL	ABFG	CA		21200.00000	0.00000		21200.00000	10000.00000	30800.00000	0.0	96.0	0.0
TAL METAL	EL	ABFG	CD	LT	5.00000	0.00000	LT	5.00000	100.00000	102.00000	0.0	102.0	0.0
TAL METAL	EL	ABFG	CO		4.46000	0.00000		3.24000	200.00000	200.00000	0.0	97.8	0.0
TAL METAL	EL	ABFG	CR		8.71000	0.00000		10.00000	200.00000	213.00000	0.0	102.1	0.0

Table F-6 Matrix Spike Data

Study Area P13

Field no:MXP13022 Medium:CGW

Test	Lab	Lot	Analyte		Native	Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	ABFG	CU		13.90000	0.00000		10.00000	200.00000	215.00000	0.0	100.6	0.0
TAL METAL	EL	ABFG	FE		6960.00000	0.00000		5710.00000	500.00000	7380.00000	0.0	84.0	0.0
TAL METAL	EL	ABFG	K		3820.00000	0.00000		3790.00000	20000.00000	23600.00000	0.0	98.9	0.0
TAL METAL	EL	ABFG	MG		3540.00000	0.00000		3180.00000	10000.00000	13800.00000	0.0	102.6	0.0
TAL METAL	EL	ABFG	MN		133.00000	0.00000		117.00000	100.00000	228.00000	0.0	95.0	0.0
TAL METAL	EL	ABFG	NA		41900.00000	0.00000		42400.00000	40000.00000	77600.00000	0.0	89.3	0.0
TAL METAL	EL	ABFG	NI	LT	10.00000	0.00000		8.17000	200.00000	197.00000	0.0	98.5	0.0
TAL METAL	EL	ABFG	V		13.60000	0.00000		11.60000	200.00000	222.00000	0.0	104.2	0.0
TAL METAL	EL	ABFG	ZN		416.00000	0.00000		265.00000	400.00000	636.00000	0.0	55.0	0.0
TAL METAL	EL	ABFJ	HG	LT	0.20000	0.00000		0.00000	4.00000	3.29000	0.0	82.3	0.0
TAL METAL	EL	ABHV	PB		2.29000	0.00000		2.71000	80.00000	83.00000	0.0	100.9	0.0
TAL METAL	EL	ABHW	SB	LT	5.00000	0.00000	LT	5.00000	80.00000	77.10000	0.0	96.4	0.0
TAL METAL	EL	ABHX	SE	LT	2.00000	0.00000	LT	2.00000	40.00000	35.20000	0.0	88.0	0.0
TAL METAL	EL	ABHY	TL	LT	2.00000	0.00000	LT	2.00000	40.00000	42.20000	0.0	105.5	0.0
TCL Pest	EL	ABFB	DLDRN	LT	0.04000	0.80000		0.98800	0.80000	0.81300	123.5	101.6	19.4
TCL Pest	EL	ABFB	ENDRN	LT	0.04000	0.80000		1.04000	0.80000	0.87100	130.0	108.9	17.7
TCL Pest	EL	ABFB	HPCL	LT	0.02000	0.40000		0.55400	0.40000	0.43100	138.5	107.8	24.9
TCL Pest	EL	ABFB	LIN	LT	0.02000	0.40000		0.60000	0.40000	0.49000	150.0	122.5	20.2
TCL Pest	EL	ABFB	MEXCLR	LT	0.20000	4.00000		5.15000	4.00000	4.29000	128.8	107.3	18.2
TCL Pest	EL	ABFB	PPDDT	LT	0.04000	0.80000		0.91400	0.80000	0.78800	114.3	98.5	14.8

Field no:WX1301X1 Medium:CSW

Test	Lab	Lot	Analyte		Native	Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	AALA	AS		3.75000	0.00000		4.60000	40.00000	47.90000	0.0	110.4	0.0
TAL METAL	EL	AALO	HG	LT	0.20000	0.00000	LT	0.20000	4.00000	3.68000	0.0	92.0	0.0
TAL METAL	EL	AALP	PB		10.40000	0.00000		11.10000	80.00000	90.50000	0.0	100.1	0.0
TAL METAL	EL	AALQ	SB	LT	5.00000	0.00000	LT	5.00000	80.00000	72.20000	0.0	90.3	0.0
TAL METAL	EL	AALR	SE	LT	2.00000	0.00000	LT	2.00000	40.00000	36.50000	0.0	91.3	0.0
TAL METAL	EL	AALS	TL	LT	2.00000	0.00000	LT	2.00000	40.00000	34.60000	0.0	86.5	0.0
TAL METAL	EL	AAOQ	AG	LT	2.00000	0.00000	LT	2.00000	40.00000	38.00000	0.0	95.0	0.0
TAL METAL	EL	AAOQ	AL		501.00000	0.00000		497.00000	500.00000	994.00000	0.0	98.6	0.0
TAL METAL	EL	AAOQ	BA		23.70000	0.00000		24.60000	200.00000	241.00000	0.0	108.7	0.0
TAL METAL	EL	AAOQ	BE	LT	5.00000	0.00000	LT	5.00000	100.00000	101.00000	0.0	101.0	0.0
TAL METAL	EL	AAOQ	CA		11000.00000	0.00000		11000.00000	10000.00000	21300.00000	0.0	103.0	0.0
TAL METAL	EL	AAOQ	CD	LT	5.00000	0.00000	LT	5.00000	100.00000	102.00000	0.0	102.0	0.0

Table F-6 Matrix Spike Data

Study Area P13

Field no:WX1301X1 Medium:CSW

Test	Lab	Lot	Analyte		Native	Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	AAOQ	CO	LT	10.00000	0.00000	LT	10.00000	200.00000	202.00000	0.0	101.0	0.0
TAL METAL	EL	AAOQ	CR	LT	10.00000	0.00000	LT	10.00000	200.00000	209.00000	0.0	104.5	0.0
TAL METAL	EL	AAOQ	CU		5.60000	0.00000		5.33000	200.00000	201.00000	0.0	97.7	0.0
TAL METAL	EL	AAOQ	FE		5000.00000	0.00000		5100.00000	500.00000	5800.00000	0.0	160.0	0.0
TAL METAL	EL	AAOQ	K		4510.00000	0.00000		6010.00000	20000.00000	25100.00000	0.0	103.0	0.0
TAL METAL	EL	AAOQ	MG		2610.00000	0.00000		2580.00000	10000.00000	12800.00000	0.0	101.9	0.0
TAL METAL	EL	AAOQ	MN		91.80000	0.00000		91.50000	100.00000	190.00000	0.0	98.2	0.0
TAL METAL	EL	AAOQ	NA		5950.00000	0.00000		6350.00000	40000.00000	48700.00000	0.0	106.9	0.0
TAL METAL	EL	AAOQ	NI	LT	10.00000	0.00000	LT	10.00000	200.00000	206.00000	0.0	103.0	0.0
TAL METAL	EL	AAOQ	V		3.38000	0.00000	LT	10.00000	200.00000	219.00000	0.0	107.8	0.0
TAL METAL	EL	AAOQ	ZN		70.80000	0.00000		52.70000	400.00000	438.00000	0.0	91.8	0.0
TCL Pest	EL	AAJV	AENSLF	LT	0.02000	0.44900		0.52300	0.44900	0.35800	116.5	79.7	37.5
TCL Pest	EL	AAJV	ALDRN	LT	0.02000	0.44900		0.43200	0.44900	0.37800	96.2	84.2	13.3
TCL Pest	EL	AAJV	DLDRN	LT	0.04000	0.89900		0.83100	0.89900	1.02000	92.4	113.5	20.5
TCL Pest	EL	AAJV	ENDRN	LT	0.04000	0.89900		0.96100	0.89900	0.78700	106.9	87.5	20.0
TCL Pest	EL	AAJV	HPCL	LT	0.02000	0.44900		0.40200	0.44900	0.35400	89.5	78.8	12.7
TCL Pest	EL	AAJV	LIN	LT	0.02000	0.44900		0.41800	0.44900	0.43500	93.1	96.9	4.0
TCL Pest	EL	AAJV	MEXCLR	LT	0.20000	4.49000		4.44000	4.49000	4.09000	98.9	91.1	8.2
TCL Pest	EL	AAJV	PPDDT	LT	0.04000	0.89900		0.88400	0.89900	0.99200	98.3	110.3	11.5

Table F-6 Matrix Spike Data

Study Area P36

Field no:MXP36011 Medium:CGW

Test	Lab	Lot	Analyte		Native	Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	AAUX	AS		34.60000	0.00000		35.20000	40.00000	75.50000	0.0	102.3	0.0
TAL METAL	EL	AAUZ	PB		24.00000	0.00000		22.60000	80.00000	100.00000	0.0	95.0	0.0
TAL METAL	EL	AAVA	SB	LT	5.00000	0.00000	LT	5.00000	80.00000	54.10000	0.0	67.6	0.0
TAL METAL	EL	AAVB	SE	LT	2.00000	0.00000	LT	2.00000	40.00000	19.90000	0.0	49.7	0.0
TAL METAL	EL	AAVC	TL	LT	2.00000	0.00000	LT	2.00000	40.00000	36.70000	0.0	91.8	0.0
TAL METAL	EL	AAVZ	AG	LT	2.00000	0.00000	LT	2.00000	40.00000	33.70000	0.0	84.3	0.0
TAL METAL	EL	AAVZ	AL		59000.00000	0.00000		84000.00000	500.00000	86000.00000	0.0	5400.0	0.0
TAL METAL	EL	AAVZ	BA		438.00000	0.00000		561.00000	200.00000	759.00000	0.0	160.5	0.0
TAL METAL	EL	AAVZ	BE		2.82000	0.00000		3.96000	100.00000	103.00000	0.0	100.2	0.0
TAL METAL	EL	AAVZ	CA		12900.00000	0.00000		14400.00000	10000.00000	24900.00000	0.0	120.0	0.0
TAL METAL	EL	AAVZ	CD	LT	5.00000	0.00000		3.34000	100.00000	99.30000	0.0	99.3	0.0
TAL METAL	EL	AAVZ	CO		45.20000	0.00000		65.80000	200.00000	252.00000	0.0	103.4	0.0
TAL METAL	EL	AAVZ	CR		163.00000	0.00000		208.00000	200.00000	406.00000	0.0	121.5	0.0
TAL METAL	EL	AAVZ	CU		125.00000	0.00000		182.00000	200.00000	365.00000	0.0	120.0	0.0
TAL METAL	EL	AAVZ	FE		80000.00000	0.00000		86000.00000	500.00000	120000.00000	0.0	8000.0	0.0
TAL METAL	EL	AAVZ	K		15500.00000	0.00000		22000.00000	20000.00000	41600.00000	0.0	130.5	0.0
TAL METAL	EL	AAVZ	MG		18200.00000	0.00000		26200.00000	10000.00000	37000.00000	0.0	188.0	0.0
TAL METAL	EL	AAVZ	MN		983.00000	0.00000		1200.00000	100.00000	1300.00000	0.0	317.0	0.0
TAL METAL	EL	AAVZ	NA		13200.00000	0.00000		14000.00000	40000.00000	55000.00000	0.0	104.5	0.0
TAL METAL	EL	AAVZ	NI		124.00000	0.00000		166.00000	200.00000	361.00000	0.0	118.5	0.0
TAL METAL	EL	AAVZ	V		123.00000	0.00000		187.00000	200.00000	386.00000	0.0	131.5	0.0
TAL METAL	EL	AAVZ	ZN		135.00000	0.00000		180.00000	400.00000	550.00000	0.0	103.8	0.0
TAL METAL	EL	AAWF	HG	LT	0.20000	0.00000	LT	0.20000	1.00000	0.86500	0.0	86.5	0.0
TCL Pest	EL	AATN	AENSLF	LT	0.04500	0.40000		0.46000	0.40000	0.46000	115.0	115.0	0.0
TCL Pest	EL	AATN	ALDRN	LT	0.04500	0.40000		0.56000	0.40000	0.56000	140.0	140.0	0.0
TCL Pest	EL	AATN	DLDRN	LT	0.09000	0.80000		0.86000	0.80000	0.88000	107.5	110.0	2.3
TCL Pest	EL	AATN	ENDRN	LT	0.09000	0.80000		0.98000	0.80000	1.00000	122.5	125.0	2.0
TCL Pest	EL	AATN	HPCL	LT	0.04500	0.40000		0.50000	0.40000	0.50000	125.0	125.0	0.0
TCL Pest	EL	AATN	LIN	LT	0.04500	0.40000		0.56000	0.40000	0.56000	140.0	140.0	0.0
TCL Pest	EL	AATN	MEXCLR	LT	0.45000	4.00000		5.20000	4.00000	5.20000	130.0	130.0	0.0
TCL Pest	EL	AATN	PPDDT	LT	0.09000	0.80000		1.10000	0.80000	1.00000	137.5	125.0	9.5
TCL VOA	EL	AATL	11DCE	LT	5.00000	50.00000		44.00000	50.00000	45.00000	88.0	90.0	2.2
TCL VOA	EL	AATL	C6H6	LT	5.00000	50.00000		44.00000	50.00000	45.00000	88.0	90.0	2.2
TCL VOA	EL	AATL	CLC6H5	LT	5.00000	50.00000		46.00000	50.00000	45.00000	92.0	90.0	2.2
TCL VOA	EL	AATL	MEC6H5	LT	5.00000	50.00000		45.00000	50.00000	44.00000	90.0	88.0	2.2
TCL VOA	EL	AATL	TRCLE	LT	5.00000	50.00000		44.00000	50.00000	45.00000	88.0	90.0	2.2

Table F-6 Matrix Spike Data

Study Area P36

Field no:MXP36011 Medium:CGW

Test	Lab	Lot	Analyte	Native		Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TPHC	EL	AAZE	TPHC		217.00000	0.00000	LT	2000.00000	36600.00000	34400.00000	0.0	93.4	0.0

Field no:BX360301 Medium:CSO

Test	Lab	Lot	Analyte	Native		Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	AAOG	HG	LT	0.09240	0.00000	LT	0.09240	2.00000	1.80180	0.0	90.1	0.0
TAL METAL	EL	AAOH	AS		5.88588	0.00000		6.65280	4.00000	9.97920	0.0	102.3	0.0
TAL METAL	EL	AAOM	PB		4.09332	0.00000		3.75144	8.00000	12.01200	0.0	99.0	0.0
TAL METAL	EL	AAON	SB	LT	0.46200	0.00000	LT	0.46200	8.00000	3.04920	0.0	38.1	0.0
TAL METAL	EL	AAOO	SE	LT	0.18480	0.00000	LT	0.18480	4.00000	2.59644	0.0	64.9	0.0
TAL METAL	EL	AAOP	TL		0.18295	0.00000		0.21529	8.00000	7.28112	0.0	88.7	0.0
TAL METAL	EL	AARK	AG	LT	0.18480	0.00000	LT	0.18480	4.00000	3.59436	0.0	89.9	0.0
TAL METAL	EL	AARK	BE		0.34742	0.00000		0.36775	10.00000	10.90320	0.0	105.6	0.0
TAL METAL	EL	AARK	CD	LT	0.46200	0.00000	LT	0.46200	10.00000	11.36520	0.0	113.7	0.0
TAL METAL	EL	AARK	CO		6.98544	0.00000		7.17948	20.00000	29.66040	0.0	113.4	0.0
TAL METAL	EL	AARK	CR		14.04480	0.00000		15.98520	40.00000	62.92440	0.0	122.2	0.0
TAL METAL	EL	AARK	CU		13.39800	0.00000		14.41440	20.00000	34.00320	0.0	103.0	0.0
TAL METAL	EL	AARK	NI		9.97920	0.00000		12.47400	20.00000	57.65760	0.0	238.4	0.0
TAL METAL	EL	AARK	V		20.14320	0.00000		22.73040	40.00000	70.59360	0.0	126.1	0.0
TAL METAL	EL	AARK	ZN		35.20440	0.00000		70.40880	40.00000	97.94400	0.0	156.8	0.0
TCL Pest	EL	AAOR	AENSLF	LT	0.00092	0.01300		0.01016	0.01300	0.01016	78.2	78.2	0.0
TCL Pest	EL	AAOR	ALDRN	LT	0.00092	0.01300		0.01109	0.01300	0.01016	85.3	78.2	8.7
TCL Pest	EL	AAOR	DLDRN	LT	0.00185	0.02700		0.02402	0.02700	0.02310	89.0	85.6	3.9
TCL Pest	EL	AAOR	ENDRN	LT	0.00185	0.02700		0.02495	0.02700	0.02402	92.4	89.0	3.7
TCL Pest	EL	AAOR	HPCL	LT	0.00092	0.01300		0.01109	0.01300	0.01109	85.3	85.3	0.0
TCL Pest	EL	AAOR	LIN	LT	0.00092	0.01300		0.01294	0.01300	0.01109	99.5	85.3	15.4
TCL Pest	EL	AAOR	MEXCLR	LT	0.00739	0.13300		0.11088	0.13300	0.12012	83.4	90.3	7.9
TCL Pest	EL	AAOR	PPDDT	LT	0.00185	0.02700		0.02587	0.02700	0.02587	95.8	95.8	0.0
TPHC	EL	AATU	TPHC	LT	18.48000	0.00000		11.82720	329.00000	304.92000	0.0	92.7	0.0

Table F-6 Matrix Spike Data

Study Area P37

Field no:MXP37012 Medium:CGW

Test	Lab	Lot	Analyte	Native		Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	ABGV	HG	LT	0.20000	0.00000		0.00000	4.00000	3.98000	0.0	99.5	0.0

Field no:DXP37021 Medium:CSE

Test	Lab	Lot	Analyte	Native		Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	AAZO	AS		1.79806	0.00000		2.23643	4.00000	5.58736	0.0	94.7	0.0
TAL METAL	EL	AAZR	AG	LT	0.14860	0.00000	LT	0.15540	4.00000	3.81159	0.0	95.3	0.0
TAL METAL	EL	AAZR	BE		0.16123	0.00000		0.15009	10.00000	9.28750	0.0	91.3	0.0
TAL METAL	EL	AAZR	CD		0.42797	0.00000		0.32915	10.00000	9.80760	0.0	93.8	0.0
TAL METAL	EL	AAZR	CO		3.49953	0.00000		3.12060	20.00000	21.47270	0.0	89.9	0.0
TAL METAL	EL	AAZR	CR		6.68700	0.00000		7.50430	40.00000	44.13420	0.0	93.6	0.0
TAL METAL	EL	AAZR	CU		3.15775	0.00000		3.11317	20.00000	22.58720	0.0	97.1	0.0
TAL METAL	EL	AAZR	NI		6.53097	0.00000		6.85789	20.00000	24.51900	0.0	89.9	0.0
TAL METAL	EL	AAZR	V		8.47020	0.00000		7.25911	40.00000	46.21460	0.0	94.4	0.0
TAL METAL	EL	AAZR	ZN		24.22180	0.00000		12.77960	40.00000	51.93570	0.0	69.3	0.0
TAL METAL	EL	AAZU	HG	LT	0.07430	0.00000	LT	0.07430	2.00000	2.08040	0.0	104.0	0.0
TAL METAL	EL	ABCC	PB		2.25872	0.00000		2.39246	8.00000	10.40200	0.0	101.8	0.0
TAL METAL	EL	ABCD	SB	LT	0.37150	0.00000	LT	0.37150	8.00000	6.35265	0.0	79.4	0.0
TAL METAL	EL	ABCE	SE	LT	0.14860	0.00000	LT	0.14860	4.00000	3.17261	0.0	79.3	0.0
TAL METAL	EL	ABCF	TL	LT	0.37150	0.00000		0.06910	8.00000	7.72720	0.0	96.6	0.0
TCL Pest	UB	AEQE	ACLDAN	LT	0.00153	0.00400		0.00536	0.00400	0.00306	134.0	76.5	54.6
TCL Pest	UB	AEQE	AENSLF		0.00077	0.00400		0.00613	0.00400	0.00306	134.0	57.3	80.1
TCL Pest	UB	AEQE	ALDRN		0.00077	0.00400		0.00383	0.00400	0.00153	76.5	19.0	120.3
TCL Pest	UB	AEQE	DLDRN		0.00306	0.00400		0.00689	0.00400	0.00383	95.8	19.3	132.8
TCL Pest	UB	AEQE	ENDRN		0.00383	0.00400		0.00996	0.00400	0.00536	153.3	38.3	120.0
TCL Pest	UB	AEQE	HPCL	LT	0.00153	0.00400		0.00383	0.00400	0.00383	95.8	95.8	0.0
TCL Pest	UB	AEQE	LIN		0.00153	0.00400		0.00460	0.00400	0.00460	76.8	76.8	0.0
TCL Pest	UB	AEQE	MEXCLR	LT	0.01532	0.04000		0.04060	0.04000	0.03217	101.5	80.4	23.2
TCL Pest	UB	AEQE	PCB016	LT	0.01532	0.04000		0.04366	0.04000	0.04519	109.2	113.0	3.4
TCL Pest	UB	AEQE	PCB260	LT	0.01532	0.04000		0.04979	0.04000	0.05822	124.5	145.6	15.6
TCL Pest	UB	AEQE	PPDDT		0.00077	0.00400		0.00306	0.00400	0.00306	57.3	57.3	0.0

Field no:BX370102 Medium:CSO

Test	Lab	Lot	Analyte	Native		Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	AAMP	AG	LT	0.15340	0.00000	LT	0.15340	4.00000	3.45917	0.0	86.5	0.0

Table F-6 Matrix Spike Data

Study Area P37

Field no:BX370102 Medium:CSO

Test	Lab	Lot	Analyte	Native		Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	AAMP	BE		0.19328	0.00000		0.18715	10.00000	9.28070	0.0	90.9	0.0
TAL METAL	EL	AAMP	CD		0.31217	0.00000		0.27919	10.00000	9.58750	0.0	92.8	0.0
TAL METAL	EL	AAMP	CO		4.83977	0.00000		4.70171	20.00000	22.62650	0.0	88.9	0.0
TAL METAL	EL	AAMP	CR		6.97970	0.00000		8.51370	40.00000	45.02290	0.0	95.1	0.0
TAL METAL	EL	AAMP	CU		7.11776	0.00000		7.16378	20.00000	25.08090	0.0	89.8	0.0
TAL METAL	EL	AAMP	NI		10.73800	0.00000		10.58460	20.00000	28.60910	0.0	89.4	0.0
TAL METAL	EL	AAMP	V		8.59040	0.00000		8.97390	40.00000	48.93460	0.0	100.9	0.0
TAL METAL	EL	AAMP	ZN		24.00710	0.00000		2.37770	40.00000	56.98810	0.0	82.5	0.0

Field no:BX370202 Medium:CSO

Test	Lab	Lot	Analyte	Native		Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	AALI	HG	LT	0.07430	0.00000	LT	0.07430	2.00000	1.27796	0.0	63.9	0.0
TAL METAL	EL	AAMI	AS		4.15337	0.00000		4.01963	4.00000	6.74644	0.0	64.8	0.0
TAL METAL	EL	AAMP	AG	LT	0.14860	0.00000	LT	0.14860	4.00000	3.64070	0.0	91.0	0.0
TAL METAL	EL	AAMP	BE		0.15009	0.00000		0.14266	10.00000	9.58470	0.0	94.3	0.0
TAL METAL	EL	AAMP	CD		0.16569	0.00000		0.27937	10.00000	9.95620	0.0	97.9	0.0
TAL METAL	EL	AAMP	CO		2.31816	0.00000		2.83826	20.00000	21.62130	0.0	96.5	0.0
TAL METAL	EL	AAMP	CR		6.04802	0.00000		6.09260	40.00000	45.39730	0.0	98.4	0.0
TAL METAL	EL	AAMP	CU		3.84874	0.00000		3.87103	20.00000	22.58720	0.0	93.7	0.0
TAL METAL	EL	AAMP	NI		4.79235	0.00000		4.89637	20.00000	24.81620	0.0	100.1	0.0
TAL METAL	EL	AAMP	V		5.92914	0.00000		6.33036	40.00000	48.36930	0.0	106.1	0.0
TAL METAL	EL	AAMP	ZN		11.21930	0.00000		11.07070	40.00000	48.59220	0.0	93.4	0.0
TAL METAL	EL	AAMU	PB		1.99124	0.00000		1.81292	8.00000	9.13890	0.0	89.3	0.0
TAL METAL	EL	AAMV	SB	LT	0.37150	0.00000	LT	0.37150	8.00000	6.91733	0.0	86.5	0.0
TAL METAL	EL	AAMW	SE	LT	0.14860	0.00000	LT	0.14860	4.00000	3.27663	0.0	81.9	0.0
TAL METAL	EL	AAMX	TL	LT	0.37150	0.00000	LT	0.37150	8.00000	7.17738	0.0	89.7	0.0
TCL Pest	EL	AAME	AENSLF	LT	0.00223	0.00000		0.00000	0.01300	0.02155	0.0	165.8	0.0
TCL Pest	EL	AAME	ALDRN	LT	0.00074	0.00000		0.00000	0.01300	0.01263	0.0	97.2	0.0
TCL Pest	EL	AAME	DLDRN	LT	0.00149	0.00000		0.00000	0.02700	0.02601	0.0	96.3	0.0
TCL Pest	EL	AAME	ENDRN	LT	0.00149	0.00000		0.00000	0.02700	0.02898	0.0	107.3	0.0
TCL Pest	EL	AAME	HPCL	LT	0.00074	0.00000		0.00000	0.01300	0.01337	0.0	102.8	0.0
TCL Pest	EL	AAME	LIN	LT	0.00074	0.00000		0.00000	0.01300	0.01263	0.0	97.2	0.0
TCL Pest	EL	AAME	MEXCLR	LT	0.00594	0.00000		0.00000	0.13300	0.13523	0.0	101.7	0.0
TCL Pest	EL	AAME	PPDDT	LT	0.00149	0.00000		0.00000	0.02700	0.02749	0.0	101.8	0.0

Table F-6 Matrix Spike Data

Study Area P37

Field no:WXP37011 Medium:CSW

Test	Lab	Lot	Analyte	Native		Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	AAZS	AG	LT	2.00000	0.00000		0.00000	40.00000	35.00000	0.0	87.5	0.0
TAL METAL	EL	AAZS	AL		7060.00000	0.00000		0.00000	500.00000	625.00000	0.0	-1287.0	0.0
TAL METAL	EL	AAZS	BA		52.20000	0.00000		0.00000	200.00000	198.00000	0.0	72.9	0.0
TAL METAL	EL	AAZS	BE		1.39000	0.00000		0.00000	100.00000	94.70000	0.0	93.3	0.0
TAL METAL	EL	AAZS	CA		7050.00000	0.00000		0.00000	10000.00000	12100.00000	0.0	50.5	0.0
TAL METAL	EL	AAZS	CD	LT	5.00000	0.00000		0.00000	100.00000	93.30000	0.0	93.3	0.0
TAL METAL	EL	AAZS	CO		7.51000	0.00000		0.00000	200.00000	186.00000	0.0	89.2	0.0
TAL METAL	EL	AAZS	CR		8.52000	0.00000		0.00000	200.00000	187.00000	0.0	89.2	0.0
TAL METAL	EL	AAZS	CU		6.27000	0.00000		0.00000	200.00000	195.00000	0.0	94.4	0.0
TAL METAL	EL	AAZS	FE		6490.00000	0.00000		0.00000	500.00000	1370.00000	0.0	-1024.0	0.0
TAL METAL	EL	AAZS	K		1060.00000	0.00000		0.00000	20000.00000	20500.00000	0.0	97.2	0.0
TAL METAL	EL	AAZS	MG		1390.00000	0.00000		0.00000	10000.00000	11000.00000	0.0	96.1	0.0
TAL METAL	EL	AAZS	MN		192.00000	0.00000		0.00000	100.00000	213.00000	0.0	21.0	0.0
TAL METAL	EL	AAZS	NA		4660.00000	0.00000		0.00000	40000.00000	43900.00000	0.0	98.1	0.0
TAL METAL	EL	AAZS	NI	LT	10.00000	0.00000		0.00000	200.00000	200.00000	0.0	100.0	0.0
TAL METAL	EL	AAZS	V		9.51000	0.00000		0.00000	200.00000	193.00000	0.0	91.7	0.0
TAL METAL	EL	AAZS	ZN		46.50000	0.00000		0.00000	400.00000	384.00000	0.0	84.4	0.0

Field no:WXP37021 Medium:CSW

Test	Lab	Lot	Analyte	Native		Spike 1		Found 1	Spike 2	Found 2	Rec 1	Rec 2	RPD
TAL METAL	EL	ABBH	AS		2.59000	0.00000		2.25000	40.00000	47.60000	0.0	112.5	0.0
TAL METAL	EL	ABBN	HG	LT	0.20000	0.00000	LT	0.20000	4.00000	4.34000	0.0	108.5	0.0
TAL METAL	EL	ABBW	PB	LT	5.00000	0.00000	LT	5.00000	80.00000	79.80000	0.0	99.8	0.0
TAL METAL	EL	ABBX	SB	LT	5.00000	0.00000	LT	5.00000	80.00000	80.90000	0.0	101.1	0.0
TAL METAL	EL	ABBY	SE	LT	2.00000	0.00000	LT	2.00000	40.00000	34.20000	0.0	85.5	0.0
TAL METAL	EL	ABBZ	TL	LT	2.00000	0.00000	LT	2.00000	40.00000	40.80000	0.0	102.0	0.0
TCL Pest	EL	AAYU	AENSLF	LT	0.02300	0.40000		0.32100	0.40000	0.31300	80.3	78.3	2.5
TCL Pest	EL	AAYU	ALDRN	LT	0.02300	0.40000		0.44700	0.40000	0.42400	111.8	106.0	5.3
TCL Pest	EL	AAYU	DLDRN	LT	0.04500	0.80000		0.85800	0.80000	0.83900	107.3	104.9	2.3
TCL Pest	EL	AAYU	ENDRN	LT	0.04500	0.80000		1.04000	0.80000	1.01000	130.0	126.3	2.9
TCL Pest	EL	AAYU	HPCL	LT	0.02300	0.40000		0.43800	0.40000	0.41700	109.5	104.3	4.9
TCL Pest	EL	AAYU	LIN	LT	0.02300	0.40000		0.44200	0.40000	0.43000	110.5	107.5	2.8
TCL Pest	EL	AAYU	MEXCLR	LT	0.22700	4.00000		4.67000	4.00000	4.47000	116.8	111.8	4.4
TCL Pest	EL	AAYU	PPDDT	LT	0.04500	0.80000		0.92800	0.80000	0.90400	116.0	113.0	2.6

MXA10071	DM7	01-sep-1993	CGW	51.00000	50.50000	50.000	UGL	102.0	0.0	AATV003
SXA10011	E3-A10-S01	14-sep-1993	CSO	0.03900	0.03700	0.048	UGG	77.1	5.0	AAXY003
SDA10011	E3-A10-S01	14-sep-1993	CSO	0.04300	0.04000	0.049	UGG	81.6	7.2	AAXY004
SXA10031	E3-A10-S03	14-sep-1993	CSO	0.04700	0.04200	0.049	UGG	85.7	10.9	AAXY005
SXA10041	E3-A10-S04	14-sep-1993	CSO	0.04400	0.03900	0.046	UGG	84.8	11.2	AAXY006
SXA10051	E3-A10-S05	14-sep-1993	CSO	0.04000	0.03500	0.049	UGG	71.4	13.1	AAXY007
DXA11011	E3-A11-D01	15-sep-1993	CSE	0.06300	0.04600	0.048	UGG	95.8	26.3	AAXZ012
WXA11011	E3-A11-D01	15-sep-1993	CSW	49.00000	49.10000	50.000	UGL	98.0	0.0	AAYB004
WXA11021	E3-A11-D02	15-sep-1993	CSW	49.00000	48.60000	50.000	UGL	98.0	0.0	AAYB005
DXA11021	E3-A11-D02	15-sep-1993	CSE	0.07900	0.04900	0.049	UGG	100.0	37.9	AAYM004
SXA10021	E3-A10-S02	15-sep-1993	CSO	0.05500	0.04900	0.049	UGG	100.0	11.6	AAYM006
EXA11011	E3-A11-P01	23-sep-1993	CSO	0.04900	0.04700	0.047	UGG	100.0	4.0	ABAH003
EXA11011	E3-A11-P01	23-sep-1993	CSO	0.04300	0.04100	0.047	UGG	87.2	4.0	ABAH011
EXA11012	E3-A11-P01	23-sep-1993	CSO	0.04500	0.04300	0.049	UGG	87.8	4.0	ABAH012
EXA11012	E3-A11-P01	23-sep-1993	CSO	0.05500	0.05200	0.050	UGG	104.0	4.6	ABAH004
EXA11021	E3-A11-P02	23-sep-1993	CSO	0.05400	0.05200	0.050	UGG	104.0	4.7	ABAH005
EXA11022	E3-A11-P02	23-sep-1993	CSO	0.05400	0.05200	0.050	UGG	104.0	4.9	ABAH006
EXA11031	E3-A11-P03	23-sep-1993	CSO	0.05100	0.04900	0.048	UGG	102.1	4.1	ABAH007
EXA11032	E3-A11-P03	23-sep-1993	CSO	0.06100	0.04900	0.048	UGG	102.1	19.0	ABAH010
EXA11042	E3-A11-P04	23-sep-1993	CSO	0.05700	0.04700	0.049	UGG	95.9	17.4	ABAH009
EXA11041	E3-A11-P04	23-sep-1993	CSO	0.05300	0.05100	0.050	UGG	102.0	3.9	ABAH008
ERA11011	E3-A11-P02	23-sep-1993	CSO	51.00000	50.80000	50.000	UGL	102.0	0.0	ABBE007
EVA11011	E3-A11-P02	23-sep-1993	CSO	48.00000	48.00000	50.000	UGL	96.0	0.0	ABBE008
WXA10022	E3-A10-D02	02-dec-1993	CSW	50.00000	50.00000	50.000	UGL	100.0	0.0	ABHA007
MVA10013	E3-A10-M01	12-jan-1994	CGW	51.00000	50.80000	50.000	UGL	102.0	0.0	ABJN009
MXA10013	E3-A10-M01	12-jan-1994	CGW	48.00000	48.40000	50.000	UGL	96.0	0.0	ABJN008

Analyte: CL4XYL Method: PST1 Lab: UB

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
SXA12031	E3-A12-S03	02-sep-1993	CSO	0.10400	0.09600	0.100	UGG	96.0	7.5	AEIB012
SXA12021	E3-A12-S02	02-sep-1993	CSO	0.10600	0.09700	0.100	UGG	97.0	9.0	AEIB011
DXA10011	E3-A10-D01	23-sep-1993	CSE	0.36100	0.09900	0.100	UGG	99.0	72.5	AEWV019
EXA11011	E3-A11-P01	23-sep-1993	CSO	0.11000	0.10600	0.100	UGG	106.0	3.8	AEWV020
EXA11012	E3-A11-P01	23-sep-1993	CSO	0.10900	0.10400	0.100	UGG	104.0	4.8	AEWV025
EXA11021	E3-A11-P02	23-sep-1993	CSO	0.10400	0.09900	0.100	UGG	99.0	4.4	AEWV026
EXA11022	E3-A11-P02	23-sep-1993	CSO	0.09100	0.08700	0.100	UGG	87.0	4.0	AEWV028
EXA11031	E3-A11-P03	23-sep-1993	CSO	0.03900	0.03700	0.100	UGG	37.0	4.7	AEWV027
EXA11032	E3-A11-P03	23-sep-1993	CSO	0.13100	0.09800	0.100	UGG	98.0	25.2	AEWV029
EXA11041	E3-A11-P04	23-sep-1993	CSO	0.08500	0.08100	0.100	UGG	81.0	4.3	AEWV030
EXA11042	E3-A11-P04	23-sep-1993	CSO	0.12100	0.10300	0.100	UGG	103.0	14.6	AEWV031
DXA11011	E3-A11-D01	15-sep-1993	CSE	0.11000	0.09300	0.100	UGG	93.0	15.3	AFOC031
DXA11021	E3-A11-D02	15-sep-1993	CSE	0.15300	0.10000	0.100	UGG	100.0	34.7	AFOC030

Analyte: DBUCLE Method: PST1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
BR1201X1	E3-A12-B01	10-aug-1993	CSO	2.20000	1.10000	2.000	UGL	110.0	0.0	AAMM013
BX120301	E3-A12-B03	10-aug-1993	CSO	0.06400	0.06000	0.067	UGG	89.6	7.3	AANE018
BX120302	E3-A12-B03	10-aug-1993	CSO	0.06800	0.05800	0.067	UGG	86.6	15.1	AANE019
BD120101	E3-A12-B01	11-aug-1993	CSO	0.08200	0.08000	0.067	UGG	119.4	3.1	AANU013

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

BX120102	E3-A12-B01	11-aug-1993	CSO	0.08800	0.07900	0.067	UGG	117.9	10.2	AANU014
BX120101	E3-A12-B01	11-aug-1993	CSO	0.07700	0.07500	0.067	UGG	111.9	3.0	AANU019
BX120201	E3-A12-B02	11-aug-1993	CSO	0.07700	0.07400	0.067	UGG	110.5	3.2	AANU015
BX120202	E3-A12-B02	11-aug-1993	CSO	0.07300	0.06700	0.067	UGG	100.0	8.5	AANU016
BX120401	E3-A12-B04	11-aug-1993	CSO	0.07800	0.07400	0.067	UGG	110.5	5.0	AANU017
BX120402	E3-A12-B04	11-aug-1993	CSO	0.08200	0.07200	0.067	UGG	107.5	12.0	AANU018
MXA11211	OHM-A11-21	30-aug-1993	CGW	1.50000	1.50000	2.000	UGL	75.0	0.0	AASU019
MXA11221	OHM-A11-22	30-aug-1993	CGW	1.90000	0.48000	2.000	UGL	95.0	0.0	AASU020
MXA11231	OHM-A11-23	30-aug-1993	CGW	2.10000	0.21000	2.000	UGL	105.0	0.0	AASU021
WXA11011	E3-A11-D01	15-sep-1993	CSW	1.06000	1.06000	2.000	UGL	53.0	0.0	AAYT010
WXA11021	E3-A11-D02	15-sep-1993	CSW	2.03000	2.03000	2.000	UGL	101.5	0.0	AAYT011
ERA11011	E3-A11-P02	23-sep-1993	CSO	2.60000	1.30000	2.400	UGL	108.3	0.0	ABBB010
WXA10011	E3-A10-D01	23-sep-1993	CSW	2.20000	1.10000	2.000	UGL	110.0	0.0	ABBB011

Analyte: DBUCLE Method: PST1 Lab: UB

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
SXA12031	E3-A12-S03	02-sep-1993	CSO	0.12000	0.11100	0.100	UGG	111.0	7.5	AEIB012
SXA12021	E3-A12-S02	02-sep-1993	CSO	0.12400	0.11300	0.100	UGG	113.0	9.0	AEIB011
DXA10011	E3-A10-D01	23-sep-1993	CSE	0.47300	0.13000	0.100	UGG	130.0	72.5	AEWV019
EXA11011	E3-A11-P01	23-sep-1993	CSO	0.13600	0.13100	0.100	UGG	131.0	3.8	AEWV020
EXA11012	E3-A11-P01	23-sep-1993	CSO	0.11800	0.11200	0.100	UGG	112.0	4.8	AEWV025
EXA11021	E3-A11-P02	23-sep-1993	CSO	0.13500	0.12900	0.100	UGG	129.0	4.4	AEWV026
EXA11022	E3-A11-P02	23-sep-1993	CSO	0.09900	0.09500	0.100	UGG	95.0	4.0	AEWV028
EXA11031	E3-A11-P03	23-sep-1993	CSO	LT 0.00200	0.00200	0.100	UGG	0.0	4.7	AEWV027
EXA11032	E3-A11-P03	23-sep-1993	CSO	0.13800	0.10300	0.100	UGG	103.0	25.2	AEWV029
EXA11041	E3-A11-P04	23-sep-1993	CSO	0.08200	0.07800	0.100	UGG	78.0	4.3	AEWV030
EXA11042	E3-A11-P04	23-sep-1993	CSO	0.13800	0.11800	0.100	UGG	118.0	14.6	AEWV031
DXA11011	E3-A11-D01	15-sep-1993	CSE	0.12200	0.10300	0.100	UGG	103.0	15.3	AFOC031
DXA11021	E3-A11-D02	15-sep-1993	CSE	0.17300	0.11300	0.100	UGG	113.0	34.7	AFOC030

Analyte: ISODR Method: PST1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
BR1201X1	E3-A12-B01	10-aug-1993	CSO	0.46000	0.23000	0.400	UGL	115.0	0.0	AAMM013
BX120301	E3-A12-B03	10-aug-1993	CSO	0.00300	0.00300	0.013	UGG	23.1	7.3	AANE018
BX120302	E3-A12-B03	10-aug-1993	CSO	0.00300	0.00200	0.013	UGG	15.4	15.1	AANE019
BD120101	E3-A12-B01	11-aug-1993	CSO	0.00900	0.00900	0.013	UGG	69.2	3.1	AANU013
BX120102	E3-A12-B01	11-aug-1993	CSO	0.00200	0.00200	0.013	UGG	15.4	10.2	AANU014
BX120101	E3-A12-B01	11-aug-1993	CSO	0.00700	0.00700	0.013	UGG	53.9	3.0	AANU019
BX120201	E3-A12-B02	11-aug-1993	CSO	0.00600	0.00600	0.013	UGG	46.2	3.2	AANU015
BX120202	E3-A12-B02	11-aug-1993	CSO	0.00500	0.00400	0.013	UGG	30.8	8.5	AANU016
BX120401	E3-A12-B04	11-aug-1993	CSO	0.01000	0.01000	0.013	UGG	76.9	5.0	AANU017
BX120402	E3-A12-B04	11-aug-1993	CSO	0.00700	0.00600	0.013	UGG	46.2	12.0	AANU018
MXA11211	OHM-A11-21	30-aug-1993	CGW	0.33900	0.33900	0.400	UGL	84.8	0.0	AASU019
MXA11221	OHM-A11-22	30-aug-1993	CGW	0.29000	0.07300	0.400	UGL	72.5	0.0	AASU020
MXA11231	OHM-A11-23	30-aug-1993	CGW	0.36000	0.03600	0.400	UGL	90.0	0.0	AASU021
WXA11011	E3-A11-D01	15-sep-1993	CSW	0.12000	0.12000	0.400	UGL	30.0	0.0	AAYT010
WXA11021	E3-A11-D02	15-sep-1993	CSW	0.26800	0.26800	0.400	UGL	67.0	0.0	AAYT011
ERA11011	E3-A11-P02	23-sep-1993	CSO	0.38000	0.19000	0.470	UGL	80.9	0.0	ABBB010
WXA10011	E3-A10-D01	23-sep-1993	CSW	0.38000	0.19000	0.400	UGL	95.0	0.0	ABBB011

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

Table F-7 Surrogate Recoveries

Study Area: P1

Analyte: 12DCD4 Method: VMS1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
DD1301X1	E3-P13-D01	02-aug-1993	CSE	0.42000	0.05500	0.049	UGG	112.2	87.0	AAJY009
DX1301X1	E3-P13-D01	02-aug-1993	CSE	0.35000	0.05100	0.050	UGG	102.0	85.5	AAJY008
DX1302X1	E3-P13-D02	02-aug-1993	CSE	0.05000	0.04900	0.050	UGG	98.0	3.5	AAJY010
DV1101X1	E3-P11-D01	03-aug-1993	CSE	49.00000	49.20000	50.000	UGL	98.0	0.0	AAKS008
WX1301X1	E3-P13-D01	02-aug-1993	CSW	49.00000	49.10000	50.000	UGL	98.0	0.0	AAKS003
DV1301X1	E3-P13-D01	02-aug-1993	CSE	48.00000	48.00000	50.000	UGL	96.0	0.0	AAKS004
WV1301X1	E3-P13-D01	02-aug-1993	CSW	49.00000	48.80000	50.000	UGL	98.0	0.0	AAKS005
DX1101X1	E3-P11-D01	03-aug-1993	CSE	0.08100	0.05400	0.050	UGG	108.0	33.2	AAKT005
DX1102X1	E3-P11-D02	03-aug-1993	CSE	0.09800	0.04700	0.049	UGG	95.9	52.1	AAKT006
DX1303X1	E3-P13-D03	03-aug-1993	CSE	0.05200	0.04500	0.049	UGG	91.8	13.2	AAKT003
DX1304X1	E3-P13-D04	03-aug-1993	CSE	0.07800	0.05000	0.050	UGG	100.0	35.9	AAKT007
DX1305X1	E3-P13-D05	03-aug-1993	CSE	0.06200	0.04400	0.048	UGG	91.7	28.6	AAKT004
MR1101X1	E3-P11-M01	24-aug-1993	CGW	50.00000	50.40000	50.000	UGL	100.0	0.0	AASA008
MX1101X1	E3-P11-M01	24-aug-1993	CGW	51.00000	50.60000	50.000	UGL	102.0	0.0	AASA004
MD1101X1	E3-P11-M01	24-aug-1993	CGW	49.00000	49.00000	50.000	UGL	98.0	0.0	AASA007
MX1302X1	E3-P13-M02	24-aug-1993	CGW	48.00000	47.80000	50.000	UGL	96.0	0.0	AASA005
MX1303X1	E3-P13-M03	25-aug-1993	CGW	51.00000	51.00000	50.000	UGL	102.0	0.0	AASA014
MX1304X1	E3-P13-M04	24-aug-1993	CGW	50.00000	50.10000	50.000	UGL	100.0	0.0	AASA006
MX1132X1	OHM-P11-32	25-aug-1993	CGW	51.00000	50.70000	50.000	UGL	102.0	0.0	AASA012
MX1133X1	OHM-P11-33	25-aug-1993	CGW	51.00000	50.60000	50.000	UGL	102.0	0.0	AASA013
MV1302X1	E3-P13-M01	25-aug-1993	CGW	50.00000	49.60000	50.000	UGL	100.0	0.0	AASN006
MX1301X1	E3-P13-M01	25-aug-1993	CGW	50.00000	49.70000	50.000	UGL	100.0	0.0	AASN012
MX1301X1	E3-P13-M01	25-aug-1993	CGW	46.00000	46.10000	50.000	UGL	92.0	0.0	AASN013
MX1301X1	E3-P13-M01	25-aug-1993	CGW	47.00000	46.80000	50.000	UGL	94.0	0.0	AASN014
SXP16011	E3-P16-S01	31-aug-1993	CSO	0.04300	0.04200	0.049	UGG	85.7	1.0	AATH011
SDP16011	E3-P16-S01	31-aug-1993	CSO	0.05200	0.05100	0.051	UGG	100.0	1.2	AATH012
SXP16021	E3-P16-S02	31-aug-1993	CSO	0.05500	0.05400	0.052	UGG	103.9	1.8	AATH013
SXP16051	E3-P16-S05	31-aug-1993	CSO	0.05200	0.05100	0.050	UGG	102.0	1.4	AATH014
SXP16061	E3-P16-S06	31-aug-1993	CSO	0.04400	0.04300	0.048	UGG	89.6	1.2	AATI003
SXP16031	E3-P16-S03	01-sep-1993	CSO	0.05000	0.04900	0.049	UGG	100.0	2.2	AATK005
SXP16041	E3-P16-S04	01-sep-1993	CSO	0.05200	0.05100	0.053	UGG	96.2	2.3	AATK006
SXP16071	E3-P16-S07	01-sep-1993	CSO	0.04600	0.04500	0.049	UGG	91.8	1.4	AATK007
SXP16081	E3-P16-S08	01-sep-1993	CSO	0.05000	0.04900	0.049	UGG	100.0	1.9	AATK008
SXP16091	E3-P16-S09	01-sep-1993	CSO	0.04500	0.04400	0.047	UGG	93.6	1.7	AATK009
SXP16101	E3-P16-S10	01-sep-1993	CSO	0.04600	0.04500	0.048	UGG	93.8	1.9	AATK010
SXP16111	E3-P16-S11	01-sep-1993	CSO	0.04700	0.04500	0.048	UGG	93.8	3.1	AATK011
SXP16121	E3-P16-S12	01-sep-1993	CSO	0.04600	0.04500	0.045	UGG	100.0	2.7	AATK012
SVP16011	E3-P16-S01	01-sep-1993	CSO	49.00000	48.90000	50.000	UGL	98.0	0.0	AATV005
MXP11A11	ATEC-1	02-sep-1993	CGW	55.00000	54.60000	50.000	UGL	110.0	0.0	AATX005
MXP11A21	ATEC-2	02-sep-1993	CGW	47.00000	46.90000	50.000	UGL	94.0	0.0	AATX006
WXP11031	E3-P11-D03	15-sep-1993	CSW	41.00000	41.20000	50.000	UGL	82.0	0.0	AAYB007
DXP11031	E3-P11-D03	15-sep-1993	CSE	0.06800	0.05000	0.050	UGG	100.0	26.8	AAYM005
MRP11012	E3-P11-M01	30-nov-1993	CGW	49.00000	49.20000	50.000	UGL	98.0	0.0	ABGX013
MVP13012	E3-P13-M01	29-nov-1993	CGW	49.00000	48.60000	50.000	UGL	98.0	0.0	ABGX005
MXP11A12	ATEC-1	30-nov-1993	CGW	49.00000	49.00000	50.000	UGL	98.0	0.0	ABGX006
MXP11A22	ATEC-2	30-nov-1993	CGW	49.00000	48.90000	50.000	UGL	98.0	0.0	ABGX007

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

MXP11012	E3-P11-M01	30-nov-1993	CGW	51.00000	50.70000	50.000	UGL	102.0	0.0	ABGX008
MXP13012	E3-P13-M01	29-nov-1993	CGW	48.00000	48.40000	50.000	UGL	96.0	0.0	ABGX003
MXP13032	E3-P13-M03	30-nov-1993	CGW	52.00000	52.00000	50.000	UGL	104.0	0.0	ABGX012
MXP13042	E3-P13-M04	29-nov-1993	CGW	49.00000	48.90000	50.000	UGL	98.0	0.0	ABGX004
MXP11EH2	EHA3	30-nov-1993	CGW	50.00000	49.70000	50.000	UGL	100.0	0.0	ABGX009
MXP11322	OHM-P11-32	30-nov-1993	CGW	52.00000	52.00000	50.000	UGL	104.0	0.0	ABGX010
MXP11332	OHM-P11-33	30-nov-1993	CGW	50.00000	49.90000	50.000	UGL	100.0	0.0	ABGX011
WDP11012	E3-P11-D01	01-dec-1993	CSW	51.00000	51.00000	50.000	UGL	102.0	0.0	ABGY013
MVP11012	E3-P11-M01	30-nov-1993	CGW	52.00000	51.80000	50.000	UGL	104.0	0.0	ABGY005
MXP13022	E3-P13-M02	30-nov-1993	CGW	51.00000	50.70000	50.000	UGL	102.0	0.0	ABGY003
WXP13052	E3-P13-D05	01-dec-1993	CSW	49.00000	49.00000	50.000	UGL	98.0	0.0	ABGZ007
WXP13042	E3-P13-D04	01-dec-1993	CSW	51.00000	50.90000	50.000	UGL	102.0	0.0	ABGZ006
WXP13032	E3-P13-D03	01-dec-1993	CSW	48.00000	47.50000	50.000	UGL	96.0	0.0	ABGZ005
WXP11022	E3-P11-D02	01-dec-1993	CSW	47.00000	47.10000	50.000	UGL	94.0	0.0	ABGZ004
WXP11012	E3-P11-D01	01-dec-1993	CSW	50.00000	49.90000	50.000	UGL	100.0	0.0	ABGZ003
WXP11042	E3-P11-D04	02-dec-1993	CSW	49.00000	49.10000	50.000	UGL	98.0	0.0	ABHA006
DXP11042	E3-P11-D04	02-dec-1993	CSE	0.25000	0.04800	0.048	UGG	100.0	80.7	ABHB010

Analyte: 246TBP Method: SMV1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
DX1301X1	E3-P13-D01	02-aug-1993	CSE	10.00000	0.33000	1.700	UGG	97.1	85.5	AAKM008
DD1301X1	E3-P13-D01	02-aug-1993	CSE	10.00000	0.25000	1.700	UGG	73.5	87.0	AAKM009
DX1302X1	E3-P13-D02	02-aug-1993	CSE	1.30000	1.28000	1.670	UGG	76.7	3.5	AAKM010
WX1301X1	E3-P13-D01	02-aug-1993	CSW	84.00000	83.50000	100.000	UGL	84.0	0.0	AAKO003
DX1101X1	E3-P11-D01	03-aug-1993	CSE	2.00000	0.28000	1.700	UGG	82.4	33.2	AAKU005
DX1102X1	E3-P11-D02	03-aug-1993	CSE	2.90000	1.40000	1.670	UGG	83.8	52.1	AAKU006
DX1303X1	E3-P13-D03	03-aug-1993	CSE	2.00000	0.30000	1.700	UGG	88.2	13.2	AAKU003
DX1304X1	E3-P13-D04	03-aug-1993	CSE	2.20000	1.39000	1.670	UGG	83.2	35.9	AAKU007
DX1305X1	E3-P13-D05	03-aug-1993	CSE	2.00000	1.46000	1.670	UGG	87.4	28.6	AAKU004
SXP16011	E3-P16-S01	31-aug-1993	CSO	0.93000	0.91700	1.670	UGG	54.9	1.0	AATA003
SDP16011	E3-P16-S01	31-aug-1993	CSO	0.85000	0.83600	1.670	UGG	50.1	1.2	AATA004
SXP16021	E3-P16-S02	31-aug-1993	CSO	0.81000	0.79800	1.670	UGG	47.8	1.8	AATA005
SXP16051	E3-P16-S05	31-aug-1993	CSO	0.90000	0.89100	1.670	UGG	53.4	1.4	AATA006
SXP16061	E3-P16-S06	31-aug-1993	CSO	0.92000	0.90900	1.670	UGG	54.4	1.2	AATA007
SXP16031	E3-P16-S03	01-sep-1993	CSO	1.20000	1.18000	1.670	UGG	70.7	2.2	AATQ003
SXP16041	E3-P16-S04	01-sep-1993	CSO	1.30000	1.28000	1.670	UGG	76.7	2.3	AATQ004
SXP16071	E3-P16-S07	01-sep-1993	CSO	0.70000	0.69400	1.670	UGG	41.6	1.4	AATQ005
SXP16081	E3-P16-S08	01-sep-1993	CSO	1.20000	1.15000	1.670	UGG	68.9	1.9	AATQ006
SXP16091	E3-P16-S09	01-sep-1993	CSO	1.20000	1.22000	1.670	UGG	73.1	1.7	AATQ007
SXP16101	E3-P16-S10	01-sep-1993	CSO	0.44000	0.42900	1.670	UGG	25.7	1.9	AATQ008
SXP16111	E3-P16-S11	01-sep-1993	CSO	1.30000	1.29000	1.670	UGG	77.3	3.1	AATQ009
SXP16121	E3-P16-S12	01-sep-1993	CSO	1.90000	1.84000	1.670	UGG	110.2	2.7	AATQ010
MXP11A11	ATEC-1	02-sep-1993	CGW	70.00000	69.60000	100.000	UGL	70.0	0.0	AAUF012
MXP11A21	ATEC-2	02-sep-1993	CGW	69.00000	68.50000	100.000	UGL	69.0	0.0	AAUF013
DXP11031	E3-P11-D03	15-sep-1993	CSE	2.10000	1.51000	1.670	UGG	90.4	26.8	AAYP006
WXP11031	E3-P11-D03	15-sep-1993	CSW	47.00000	47.30000	100.000	UGL	47.0	0.0	AAYQ006
MRP11012	E3-P11-M01	30-nov-1993	CGW	87.00000	87.10000	100.000	UGL	87.0	0.0	ABFC010
MXP11A12	ATEC-1	30-nov-1993	CGW	77.00000	76.90000	114.000	UGL	67.5	0.0	ABFC003
MXP11A22	ATEC-2	30-nov-1993	CGW	57.00000	57.20000	100.000	UGL	57.0	0.0	ABFC004
MXP11012	E3-P11-M01	30-nov-1993	CGW	60.00000	60.10000	100.000	UGL	60.0	0.0	ABFC005

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

MXP13022	E3-P13-M02	30-nov-1993	CGW	83.00000	82.50000	100.000	UGL	83.0	0.0	ABFC011
MXP13032	E3-P13-M03	30-nov-1993	CGW	75.00000	74.50000	100.000	UGL	75.0	0.0	ABFC009
MXP11EH2	EHA3	30-nov-1993	CGW	75.00000	74.70000	100.000	UGL	75.0	0.0	ABFC006
MXP11322	OHM-P11-32	30-nov-1993	CGW	76.00000	75.50000	100.000	UGL	76.0	0.0	ABFC007
MXP11332	OHM-P11-33	30-nov-1993	CGW	66.00000	66.10000	122.000	UGL	54.1	0.0	ABFC008
MXP13012	E3-P13-M01	29-nov-1993	CGW	65.00000	64.60000	100.000	UGL	65.0	0.0	ABFN003
MXP13042	E3-P13-M04	29-nov-1993	CGW	60.00000	59.90000	100.000	UGL	60.0	0.0	ABFN004
SDP16102	E3-P16-S10	01-dec-1993	CSO	1.40000	1.29000	1.670	UGG	77.3	8.6	ABFT007
SXP16102	E3-P16-S10	01-dec-1993	CSO	1.50000	1.40000	1.670	UGG	83.8	6.4	ABFT008
WDP11012	E3-P11-D01	01-dec-1993	CSW	48.00000	47.70000	100.000	UGL	48.0	0.0	ABFV010
WXP11012	E3-P11-D01	01-dec-1993	CSW	67.00000	66.80000	100.000	UGL	67.0	0.0	ABFV011
WXP11022	E3-P11-D02	01-dec-1993	CSW	59.00000	58.60000	127.000	UGL	46.5	0.0	ABFV012
WXP13032	E3-P13-D03	01-dec-1993	CSW	70.00000	69.60000	100.000	UGL	70.0	0.0	ABFV013
WXP13042	E3-P13-D04	01-dec-1993	CSW	55.00000	54.50000	112.000	UGL	49.1	0.0	ABFV014
DXP11042	E3-P11-D04	02-dec-1993	CSE	7.90000	1.53000	1.670	UGG	91.6	80.7	ABGL004
WXP11042	E3-P11-D04	02-dec-1993	CSW	18.00000	17.60000	112.000	UGL	16.1	0.0	ABGM013
WXP13052	E3-P13-D05	01-dec-1993	CSW	56.00000	55.50000	116.000	UGL	48.3	0.0	ABGM003

Analyte: 2A46DT Method: EXL2 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
DXP11042	E3-P11-D04	02-dec-1993	CSE	355.00000	68.50000	80.000	UGG	85.6	80.7	ABFQ005

Analyte: 2FBP Method: SMV1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
DX1301X1	E3-P13-D01	02-aug-1993	CSE	10.00000	0.29000	1.700	UGG	85.3	85.5	AAKM008
DD1301X1	E3-P13-D01	02-aug-1993	CSE	9.00000	0.24000	1.700	UGG	70.6	87.0	AAKM009
DX1302X1	E3-P13-D02	02-aug-1993	CSE	1.20000	1.12000	1.670	UGG	67.1	3.5	AAKM010
WX1301X1	E3-P13-D01	02-aug-1993	CSW	95.00000	95.40000	100.000	UGL	95.0	0.0	AAKO003
DX1101X1	E3-P11-D01	03-aug-1993	CSE	2.00000	0.28000	1.700	UGG	82.4	33.2	AAKU005
DX1102X1	E3-P11-D02	03-aug-1993	CSE	2.70000	1.27000	1.670	UGG	76.1	52.1	AAKU006
DX1303X1	E3-P13-D03	03-aug-1993	CSE	2.00000	0.34000	1.700	UGG	100.0	13.2	AAKU003
DX1304X1	E3-P13-D04	03-aug-1993	CSE	1.70000	1.09000	1.670	UGG	65.3	35.9	AAKU007
DX1305X1	E3-P13-D05	03-aug-1993	CSE	1.50000	1.10000	1.670	UGG	65.9	28.6	AAKU004
SXP16011	E3-P16-S01	31-aug-1993	CSO	1.20000	1.20000	1.670	UGG	71.9	1.0	AATA003
SDP16011	E3-P16-S01	31-aug-1993	CSO	0.97000	0.96200	1.670	UGG	57.6	1.2	AATA004
SXP16021	E3-P16-S02	31-aug-1993	CSO	1.20000	1.14000	1.670	UGG	68.3	1.8	AATA005
SXP16051	E3-P16-S05	31-aug-1993	CSO	0.85000	0.84300	1.670	UGG	50.5	1.4	AATA006
SXP16061	E3-P16-S06	31-aug-1993	CSO	0.84000	0.82700	1.670	UGG	49.5	1.2	AATA007
SXP16031	E3-P16-S03	01-sep-1993	CSO	1.00000	1.01000	1.670	UGG	60.5	2.2	AATQ003
SXP16041	E3-P16-S04	01-sep-1993	CSO	1.10000	1.09000	1.670	UGG	65.3	2.3	AATQ004
SXP16071	E3-P16-S07	01-sep-1993	CSO	0.68000	0.67200	1.670	UGG	40.2	1.4	AATQ005
SXP16081	E3-P16-S08	01-sep-1993	CSO	0.97000	0.94900	1.670	UGG	56.8	1.9	AATQ006
SXP16091	E3-P16-S09	01-sep-1993	CSO	1.10000	1.04000	1.670	UGG	62.3	1.7	AATQ007
SXP16101	E3-P16-S10	01-sep-1993	CSO	0.03900	0.03800	1.670	UGG	2.3	1.9	AATQ008
SXP16111	E3-P16-S11	01-sep-1993	CSO	1.30000	1.24000	1.670	UGG	74.3	3.1	AATQ009
SXP16121	E3-P16-S12	01-sep-1993	CSO	1.30000	1.26000	1.670	UGG	75.5	2.7	AATQ010
MXP11A11	ATEC-1	02-sep-1993	CGW	68.00000	68.10000	100.000	UGL	68.0	0.0	AAUF012
MXP11A21	ATEC-2	02-sep-1993	CGW	71.00000	71.30000	100.000	UGL	71.0	0.0	AAUF013
DXP11031	E3-P11-D03	15-sep-1993	CSE	2.40000	1.74000	1.670	UGG	104.2	26.8	AAYP006

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

WXP11031	E3-P11-D03	15-sep-1993	CSW	75.00000	74.60000	100.000	UGL	75.0	0.0	AAYQ006
MRP11012	E3-P11-M01	30-nov-1993	CGW	82.00000	82.30000	100.000	UGL	82.0	0.0	ABFC010
MXP11A12	ATEC-1	30-nov-1993	CGW	84.00000	83.60000	114.000	UGL	73.7	0.0	ABFC003
MXP11A22	ATEC-2	30-nov-1993	CGW	96.00000	95.80000	100.000	UGL	96.0	0.0	ABFC004
MXP11012	E3-P11-M01	30-nov-1993	CGW	97.00000	97.20000	100.000	UGL	97.0	0.0	ABFC005
MXP13022	E3-P13-M02	30-nov-1993	CGW	97.00000	96.80000	100.000	UGL	97.0	0.0	ABFC011
MXP13032	E3-P13-M03	30-nov-1993	CGW	85.00000	85.20000	100.000	UGL	85.0	0.0	ABFC009
MXP11EH2	EHA3	30-nov-1993	CGW	96.00000	95.70000	100.000	UGL	96.0	0.0	ABFC006
MXP11322	OHM-P11-32	30-nov-1993	CGW	90.00000	89.60000	100.000	UGL	90.0	0.0	ABFC007
MXP11332	OHM-P11-33	30-nov-1993	CGW	110.00000	109.00000	122.000	UGL	90.2	0.0	ABFC008
MXP13012	E3-P13-M01	29-nov-1993	CGW	88.00000	88.10000	100.000	UGL	88.0	0.0	ABFN003
MXP13042	E3-P13-M04	29-nov-1993	CGW	90.00000	89.50000	100.000	UGL	90.0	0.0	ABFN004
SDP16102	E3-P16-S10	01-dec-1993	CSO	1.30000	1.18000	1.670	UGG	70.7	8.6	ABFT007
SXP16102	E3-P16-S10	01-dec-1993	CSO	1.30000	1.22000	1.670	UGG	73.1	6.4	ABFT008
WDP11012	E3-P11-D01	01-dec-1993	CSW	78.00000	78.00000	100.000	UGL	78.0	0.0	ABFV010
WXP11012	E3-P11-D01	01-dec-1993	CSW	71.00000	70.60000	100.000	UGL	71.0	0.0	ABFV011
WXP11022	E3-P11-D02	01-dec-1993	CSW	99.00000	99.10000	127.000	UGL	78.0	0.0	ABFV012
WXP13032	E3-P13-D03	01-dec-1993	CSW	84.00000	83.90000	100.000	UGL	84.0	0.0	ABFV013
WXP13042	E3-P13-D04	01-dec-1993	CSW	100.00000	101.00000	112.000	UGL	89.3	0.0	ABFV014
DXP11042	E3-P11-D04	02-dec-1993	CSE	8.70000	1.67000	1.670	UGG	100.0	80.7	ABGL004
WXP11042	E3-P11-D04	02-dec-1993	CSW	96.00000	95.60000	112.000	UGL	85.7	0.0	ABGM013
WXP13052	E3-P13-D05	01-dec-1993	CSW	92.00000	91.60000	116.000	UGL	79.3	0.0	ABGM003

Analyte: 2FP Method: SMV1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
DX1301X1	E3-P13-D01	02-aug-1993	CSE	8.00000	0.22000	1.700	UGG	64.7	85.5	AAKM008
DD1301X1	E3-P13-D01	02-aug-1993	CSE	8.00000	0.20000	1.700	UGG	58.8	87.0	AAKM009
DX1302X1	E3-P13-D02	02-aug-1993	CSE	0.91000	0.88100	1.670	UGG	52.8	3.5	AAKM010
WX1301X1	E3-P13-D01	02-aug-1993	CSW	63.00000	62.60000	100.000	UGL	63.0	0.0	AAKO003
DX1101X1	E3-P11-D01	03-aug-1993	CSE	2.00000	0.22000	1.700	UGG	64.7	33.2	AAKU005
DX1102X1	E3-P11-D02	03-aug-1993	CSE	2.20000	1.04000	1.670	UGG	62.3	52.1	AAKU006
DX1303X1	E3-P13-D03	03-aug-1993	CSE	1.00000	0.25000	1.700	UGG	73.5	13.2	AAKU003
DX1304X1	E3-P13-D04	03-aug-1993	CSE	1.50000	0.94600	1.670	UGG	56.7	35.9	AAKU007
DX1305X1	E3-P13-D05	03-aug-1993	CSE	1.30000	0.95800	1.670	UGG	57.4	28.6	AAKU004
SXP16011	E3-P16-S01	31-aug-1993	CSO	1.10000	1.07000	1.670	UGG	64.1	1.0	AATA003
SDP16011	E3-P16-S01	31-aug-1993	CSO	0.80000	0.79300	1.670	UGG	47.5	1.2	AATA004
SXP16021	E3-P16-S02	31-aug-1993	CSO	0.94000	0.92800	1.670	UGG	55.6	1.8	AATA005
SXP16051	E3-P16-S05	31-aug-1993	CSO	0.61000	0.60200	1.670	UGG	36.1	1.4	AATA006
SXP16061	E3-P16-S06	31-aug-1993	CSO	0.61000	0.60300	1.670	UGG	36.1	1.2	AATA007
SXP16031	E3-P16-S03	01-sep-1993	CSO	1.00000	0.98800	1.670	UGG	59.2	2.2	AATQ003
SXP16041	E3-P16-S04	01-sep-1993	CSO	1.10000	1.06000	1.670	UGG	63.5	2.3	AATQ004
SXP16071	E3-P16-S07	01-sep-1993	CSO	0.63000	0.62100	1.670	UGG	37.2	1.4	AATQ005
SXP16081	E3-P16-S08	01-sep-1993	CSO	0.86000	0.83900	1.670	UGG	50.2	1.9	AATQ006
SXP16091	E3-P16-S09	01-sep-1993	CSO	0.90000	0.88200	1.670	UGG	52.8	1.7	AATQ007
SXP16101	E3-P16-S10	01-sep-1993	CSO	0.33000	0.31900	1.670	UGG	19.1	1.9	AATQ008
SXP16111	E3-P16-S11	01-sep-1993	CSO	1.00000	0.97300	1.670	UGG	58.3	3.1	AATQ009
SXP16121	E3-P16-S12	01-sep-1993	CSO	1.10000	1.06000	1.670	UGG	63.5	2.7	AATQ010
MXP11A11	ATEC-1	02-sep-1993	CGW	48.00000	48.30000	100.000	UGL	48.0	0.0	AAUF012
MXP11A21	ATEC-2	02-sep-1993	CGW	47.00000	46.50000	100.000	UGL	47.0	0.0	AAUF013
DXP11031	E3-P11-D03	15-sep-1993	CSE	1.90000	1.39000	1.670	UGG	83.2	26.8	AAYP006

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

WXP11031	E3-P11-D03	15-sep-1993	CSW	30.00000	29.60000	100.000	UGL	30.0	0.0	AAYQ006
MRP11012	E3-P11-M01	30-nov-1993	CGW	62.00000	62.40000	100.000	UGL	62.0	0.0	ABFC010
MXP11A12	ATEC-1	30-nov-1993	CGW	57.00000	57.30000	114.000	UGL	50.0	0.0	ABFC003
MXP11A22	ATEC-2	30-nov-1993	CGW	45.00000	45.20000	100.000	UGL	45.0	0.0	ABFC004
MXP11012	E3-P11-M01	30-nov-1993	CGW	39.00000	39.20000	100.000	UGL	39.0	0.0	ABFC005
MXP13022	E3-P13-M02	30-nov-1993	CGW	58.00000	57.80000	100.000	UGL	58.0	0.0	ABFC011
MXP13032	E3-P13-M03	30-nov-1993	CGW	51.00000	51.00000	100.000	UGL	51.0	0.0	ABFC009
MXP11EH2	EHA3	30-nov-1993	CGW	54.00000	53.80000	100.000	UGL	54.0	0.0	ABFC006
MXP11322	OHM-P11-32	30-nov-1993	CGW	56.00000	56.40000	100.000	UGL	56.0	0.0	ABFC007
MXP11332	OHM-P11-33	30-nov-1993	CGW	46.00000	46.00000	122.000	UGL	37.7	0.0	ABFC008
MXP13012	E3-P13-M01	29-nov-1993	CGW	54.00000	54.40000	100.000	UGL	54.0	0.0	ABFN003
MXP13042	E3-P13-M04	29-nov-1993	CGW	48.00000	48.40000	100.000	UGL	48.0	0.0	ABFN004
SDP16102	E3-P16-S10	01-dec-1993	CSO	1.40000	1.30000	1.670	UGG	77.8	8.6	ABFT007
SXP16102	E3-P16-S10	01-dec-1993	CSO	1.50000	1.37000	1.670	UGG	82.0	6.4	ABFT008
WDP11012	E3-P11-D01	01-dec-1993	CSW	38.00000	38.00000	100.000	UGL	38.0	0.0	ABFV010
WXP11012	E3-P11-D01	01-dec-1993	CSW	47.00000	47.10000	100.000	UGL	47.0	0.0	ABFV011
WXP11022	E3-P11-D02	01-dec-1993	CSW	52.00000	52.30000	127.000	UGL	40.9	0.0	ABFV012
WXP13032	E3-P13-D03	01-dec-1993	CSW	49.00000	49.40000	100.000	UGL	49.0	0.0	ABFV013
WXP13042	E3-P13-D04	01-dec-1993	CSW	34.00000	34.40000	112.000	UGL	30.4	0.0	ABFV014
DXP11042	E3-P11-D04	02-dec-1993	CSE	8.30000	1.61000	1.670	UGG	96.4	80.7	ABGL004
WXP11042	E3-P11-D04	02-dec-1993	CSW	10.00000	10.30000	112.000	UGL	8.9	0.0	ABGM013
WXP13052	E3-P13-D05	01-dec-1993	CSW	36.00000	35.50000	116.000	UGL	31.0	0.0	ABGM003

Analyte: 34DNT Method: EXL1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
DXP11042	E3-P11-D04	02-dec-1993	CSE	40.10000	7.73000	8.000	UGG	96.6	80.7	ABFO005

Analyte: 4BFB Method: VMS1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
DD1301X1	E3-P13-D01	02-aug-1993	CSE	0.27000	0.03500	0.049	UGG	71.4	87.0	AAJY009
DX1301X1	E3-P13-D01	02-aug-1993	CSE	0.23000	0.03400	0.050	UGG	68.0	85.5	AAJY008
DX1302X1	E3-P13-D02	02-aug-1993	CSE	0.04400	0.04300	0.050	UGG	86.0	3.5	AAJY010
DV1101X1	E3-P11-D01	03-aug-1993	CSE	45.00000	44.70000	50.000	UGL	90.0	0.0	AAKS008
WX1301X1	E3-P13-D01	02-aug-1993	CSW	45.00000	45.40000	50.000	UGL	90.0	0.0	AAKS003
DV1301X1	E3-P13-D01	02-aug-1993	CSE	45.00000	44.50000	50.000	UGL	90.0	0.0	AAKS004
WV1301X1	E3-P13-D01	02-aug-1993	CSW	46.00000	45.60000	50.000	UGL	92.0	0.0	AAKS005
DX1101X1	E3-P11-D01	03-aug-1993	CSE	0.06500	0.04300	0.050	UGG	86.0	33.2	AAKT005
DX1102X1	E3-P11-D02	03-aug-1993	CSE	0.07500	0.03600	0.049	UGG	73.5	52.1	AAKT006
DX1303X1	E3-P13-D03	03-aug-1993	CSE	0.04900	0.04300	0.049	UGG	87.8	13.2	AAKT003
DX1304X1	E3-P13-D04	03-aug-1993	CSE	0.06900	0.04400	0.050	UGG	88.0	35.9	AAKT007
DX1305X1	E3-P13-D05	03-aug-1993	CSE	0.05400	0.03900	0.048	UGG	81.3	28.6	AAKT004
MR1101X1	E3-P11-M01	24-aug-1993	CGW	51.00000	51.00000	50.000	UGL	102.0	0.0	AASA008
MX1101X1	E3-P11-M01	24-aug-1993	CGW	50.00000	49.80000	50.000	UGL	100.0	0.0	AASA004
MD1101X1	E3-P11-M01	24-aug-1993	CGW	51.00000	50.70000	50.000	UGL	102.0	0.0	AASA007
MX1302X1	E3-P13-M02	24-aug-1993	CGW	52.00000	52.20000	50.000	UGL	104.0	0.0	AASA005
MX1303X1	E3-P13-M03	25-aug-1993	CGW	52.00000	51.80000	50.000	UGL	104.0	0.0	AASA014
MX1304X1	E3-P13-M04	24-aug-1993	CGW	51.00000	50.50000	50.000	UGL	102.0	0.0	AASA006
MX1132X1	OHM-P11-32	25-aug-1993	CGW	50.00000	50.20000	50.000	UGL	100.0	0.0	AASA012
MX1133X1	OHM-P11-33	25-aug-1993	CGW	5.00000	5.02000	50.000	UGL	10.0	0.0	AASA013

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

MV1302X1	E3-P13-M01	25-aug-1993	CGW	47.00000	46.50000	50.000	UGL	94.0	0.0	AASN006
MX1301X1	E3-P13-M01	25-aug-1993	CGW	46.00000	46.40000	50.000	UGL	92.0	0.0	AASN012
MX1301X1	E3-P13-M01	25-aug-1993	CGW	49.00000	48.60000	50.000	UGL	98.0	0.0	AASN013
MX1301X1	E3-P13-M01	25-aug-1993	CGW	48.00000	48.20000	50.000	UGL	96.0	0.0	AASN014
SXP16011	E3-P16-S01	31-aug-1993	CSO	0.03800	0.03800	0.049	UGG	77.6	1.0	AATH011
SDP16011	E3-P16-S01	31-aug-1993	CSO	0.04500	0.04400	0.051	UGG	86.3	1.2	AATH012
SXP16021	E3-P16-S02	31-aug-1993	CSO	0.04900	0.04900	0.052	UGG	94.2	1.8	AATH013
SXP16051	E3-P16-S05	31-aug-1993	CSO	0.04800	0.04800	0.050	UGG	96.0	1.4	AATH014
SXP16061	E3-P16-S06	31-aug-1993	CSO	0.04300	0.04300	0.048	UGG	89.6	1.2	AATI003
SXP16031	E3-P16-S03	01-sep-1993	CSO	0.05300	0.05200	0.049	UGG	106.1	2.2	AATK005
SXP16041	E3-P16-S04	01-sep-1993	CSO	0.05200	0.05100	0.053	UGG	96.2	2.3	AATK006
SXP16071	E3-P16-S07	01-sep-1993	CSO	0.04300	0.04300	0.049	UGG	87.8	1.4	AATK007
SXP16081	E3-P16-S08	01-sep-1993	CSO	0.04900	0.04800	0.049	UGG	98.0	1.9	AATK008
SXP16091	E3-P16-S09	01-sep-1993	CSO	0.04200	0.04200	0.047	UGG	89.4	1.7	AATK009
SXP16101	E3-P16-S10	01-sep-1993	CSO	0.04200	0.04100	0.048	UGG	85.4	1.9	AATK010
SXP16111	E3-P16-S11	01-sep-1993	CSO	0.04900	0.04700	0.048	UGG	97.9	3.1	AATK011
SXP16121	E3-P16-S12	01-sep-1993	CSO	0.04700	0.04600	0.045	UGG	102.2	2.7	AATK012
SVP16011	E3-P16-S01	01-sep-1993	CSO	47.00000	46.60000	50.000	UGL	94.0	0.0	AATV005
MXP11A11	ATEC-1	02-sep-1993	CGW	48.00000	48.40000	50.000	UGL	96.0	0.0	AATX005
MXP11A21	ATEC-2	02-sep-1993	CGW	50.00000	50.40000	50.000	UGL	100.0	0.0	AATX006
WXP11031	E3-P11-D03	15-sep-1993	CSW	47.00000	47.00000	50.000	UGL	94.0	0.0	AAYB007
DXP11031	E3-P11-D03	15-sep-1993	CSE	0.06800	0.05000	0.050	UGG	100.0	26.8	AAYM005
MRP11012	E3-P11-M01	30-nov-1993	CGW	53.00000	53.10000	50.000	UGL	106.0	0.0	ABGX013
MVP13012	E3-P13-M01	29-nov-1993	CGW	52.00000	52.00000	50.000	UGL	104.0	0.0	ABGX005
MXP11A12	ATEC-1	30-nov-1993	CGW	51.00000	50.90000	50.000	UGL	102.0	0.0	ABGX006
MXP11A22	ATEC-2	30-nov-1993	CGW	51.00000	50.50000	50.000	UGL	102.0	0.0	ABGX007
MXP11012	E3-P11-M01	30-nov-1993	CGW	49.00000	49.30000	50.000	UGL	98.0	0.0	ABGX008
MXP13012	E3-P13-M01	29-nov-1993	CGW	50.00000	49.90000	50.000	UGL	100.0	0.0	ABGX003
MXP13032	E3-P13-M03	30-nov-1993	CGW	52.00000	52.30000	50.000	UGL	104.0	0.0	ABGX012
MXP13042	E3-P13-M04	29-nov-1993	CGW	49.00000	48.90000	50.000	UGL	98.0	0.0	ABGX004
MXP11EH2	EHA3	30-nov-1993	CGW	51.00000	50.90000	50.000	UGL	102.0	0.0	ABGX009
MXP11322	OHM-P11-32	30-nov-1993	CGW	51.00000	51.40000	50.000	UGL	102.0	0.0	ABGX010
MXP11332	OHM-P11-33	30-nov-1993	CGW	51.00000	50.60000	50.000	UGL	102.0	0.0	ABGX011
WDP11012	E3-P11-D01	01-dec-1993	CSW	50.00000	50.40000	50.000	UGL	100.0	0.0	ABGY013
MVP11012	E3-P11-M01	30-nov-1993	CGW	52.00000	52.20000	50.000	UGL	104.0	0.0	ABGY005
MXP13022	E3-P13-M02	30-nov-1993	CGW	51.00000	50.90000	50.000	UGL	102.0	0.0	ABGY003
WXP13052	E3-P13-D05	01-dec-1993	CSW	50.00000	50.40000	50.000	UGL	100.0	0.0	ABGZ007
WXP13042	E3-P13-D04	01-dec-1993	CSW	50.00000	49.70000	50.000	UGL	100.0	0.0	ABGZ006
WXP13032	E3-P13-D03	01-dec-1993	CSW	49.00000	49.10000	50.000	UGL	98.0	0.0	ABGZ005
WXP11022	E3-P11-D02	01-dec-1993	CSW	51.00000	51.20000	50.000	UGL	102.0	0.0	ABGZ004
WXP11012	E3-P11-D01	01-dec-1993	CSW	50.00000	50.40000	50.000	UGL	100.0	0.0	ABGZ003
WXP11042	E3-P11-D04	02-dec-1993	CSW	47.00000	47.10000	50.000	UGL	94.0	0.0	ABHA006
DXP11042	E3-P11-D04	02-dec-1993	CSE	0.20000	0.03900	0.048	UGG	81.3	80.7	ABHB010

Analyte: CL4XYL Method: PST1 Lab: UB

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
SXP16011	E3-P16-S01	31-aug-1993	CSO	0.11400	0.11300	0.100	UGG	113.0	0.9	AEHH018
SDP16011	E3-P16-S01	31-aug-1993	CSO	0.11200	0.11100	0.100	UGG	111.0	1.1	AEHH019
SXP16021	E3-P16-S02	31-aug-1993	CSO	0.11300	0.11000	0.100	UGG	110.0	2.5	AEHH020
SXP16051	E3-P16-S05	31-aug-1993	CSO	0.10900	0.10800	0.100	UGG	108.0	0.9	AEHH021

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
SXP16061	E3-P16-S06	31-aug-1993	CSO	0.10200	0.10100	0.100	UGG	101.0	1.2	AEHH022
SXP16121	E3-P16-S12	01-sep-1993	CSO	0.10400	0.10100	0.100	UGG	101.0	2.6	AEIB028
SXP16111	E3-P16-S11	01-sep-1993	CSO	0.10600	0.10300	0.100	UGG	103.0	2.8	AEIB027
SXP16101	E3-P16-S10	01-sep-1993	CSO	0.10300	0.10100	0.100	UGG	101.0	1.6	AEIB026
SXP16091	E3-P16-S09	01-sep-1993	CSO	0.09900	0.09800	0.100	UGG	98.0	1.5	AEIB025
SXP16081	E3-P16-S08	01-sep-1993	CSO	0.10200	0.10100	0.100	UGG	101.0	1.3	AEIB024
SXP16071	E3-P16-S07	01-sep-1993	CSO	0.10400	0.10200	0.100	UGG	102.0	2.1	AEIB023
SXP16041	E3-P16-S04	01-sep-1993	CSO	0.09800	0.09700	0.100	UGG	97.0	1.7	AEIB022
SXP16031	E3-P16-S03	01-sep-1993	CSO	0.09900	0.09700	0.100	UGG	97.0	1.4	AEIB021
DXP11031	E3-P11-D03	15-sep-1993	CSE	0.13200	0.10800	0.100	UGG	108.0	18.0	AFOC032

Analyte: DBUCLE Method: PST1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
WX1301X1	E3-P13-D01	02-aug-1993	CSW	0.47500	0.47500	2.000	UGL	23.8	0.0	AAJV010
WX1301X1	E3-P13-D01	02-aug-1993	CSW	1.97000	1.97000	2.250	UGL	87.6	0.0	AAJV011
WX1301X1	E3-P13-D01	02-aug-1993	CSW	2.24000	2.24000	2.250	UGL	99.6	0.0	AAJV012
DX1301X1	E3-P13-D01	02-aug-1993	CSE	0.45000	0.00700	0.067	UGG	104.5	85.5	AAKL015
DD1301X1	E3-P13-D01	02-aug-1993	CSE	0.31000	0.00400	0.067	UGG	59.7	87.0	AAKL016
DX1302X1	E3-P13-D02	02-aug-1993	CSE	0.09900	0.02400	0.067	UGG	143.3	3.5	AAKL017
DX1101X1	E3-P11-D01	03-aug-1993	CSE	0.09000	0.01200	0.067	UGG	89.6	33.2	AAKW012
DX1102X1	E3-P11-D02	03-aug-1993	CSE	0.14000	0.00700	0.067	UGG	104.5	52.1	AAKW013
DX1303X1	E3-P13-D03	03-aug-1993	CSE	0.07500	0.00300	0.067	UGG	111.9	13.2	AAKW010
DX1304X1	E3-P13-D04	03-aug-1993	CSE	0.11000	0.01400	0.067	UGG	104.5	35.9	AAKW014
DX1305X1	E3-P13-D05	03-aug-1993	CSE	0.11000	0.02000	0.067	UGG	119.4	28.6	AAKW011
MX1101X1	E3-P11-M01	24-aug-1993	CGW	1.83000	1.83000	2.000	UGL	91.5	0.0	AARO018
MR1101X1	E3-P11-M01	24-aug-1993	CGW	2.29000	2.29000	2.000	UGL	114.5	0.0	AASG013
MD1101X1	E3-P11-M01	24-aug-1993	CGW	2.17000	2.17000	2.000	UGL	108.5	0.0	AASG012
MX1302X1	E3-P13-M02	24-aug-1993	CGW	2.02000	2.02000	2.000	UGL	101.0	0.0	AASG010
MX1304X1	E3-P13-M04	24-aug-1993	CGW	1.24000	1.24000	2.000	UGL	62.0	0.0	AASG011
MX1301X1	E3-P13-M01	25-aug-1993	CGW	1.70000	0.43000	2.000	UGL	85.0	0.0	AASO014
MX1301X1	E3-P13-M01	25-aug-1993	CGW	1.70000	0.43000	2.000	UGL	85.0	0.0	AASO019
MX1301X1	E3-P13-M01	25-aug-1993	CGW	2.00000	0.49000	2.000	UGL	100.0	0.0	AASO020
MX1303X1	E3-P13-M03	25-aug-1993	CGW	1.90000	0.48000	2.000	UGL	95.0	0.0	AASO012
MX1132X1	OHM-P11-32	25-aug-1993	CGW	0.29200	0.29200	2.000	UGL	14.6	0.0	AASO010
MX1133X1	OHM-P11-33	25-aug-1993	CGW	1.00000	0.26000	2.000	UGL	50.0	0.0	AASO011
MXP11A11	ATEC-1	02-sep-1993	CGW	2.13000	2.13000	2.000	UGL	106.5	0.0	AAUJ019
MXP11A21	ATEC-2	02-sep-1993	CGW	2.19000	2.19000	2.000	UGL	109.5	0.0	AAUJ020
WXP11031	E3-P11-D03	15-sep-1993	CSW	2.11000	2.11000	2.000	UGL	105.5	0.0	AAYT013
MXP13022	E3-P13-M02	30-nov-1993	CGW	1.83000	1.83000	2.000	UGL	91.5	0.0	ABFB022
MXP13022	E3-P13-M02	30-nov-1993	CGW	1.65000	1.65000	2.000	UGL	82.5	0.0	ABFB021
MXP13042	E3-P13-M04	29-nov-1993	CGW	1.32000	1.32000	2.000	UGL	66.0	0.0	ABFB020
MXP13012	E3-P13-M01	29-nov-1993	CGW	1.73000	1.73000	2.000	UGL	86.5	0.0	ABFB019
MXP13022	E3-P13-M02	30-nov-1993	CGW	1.60000	1.60000	2.000	UGL	80.0	0.0	ABFB018
MRP11012	E3-P11-M01	30-nov-1993	CGW	1.47000	1.47000	2.000	UGL	73.5	0.0	ABFB017
MXP13032	E3-P13-M03	30-nov-1993	CGW	1.48000	1.48000	2.000	UGL	74.0	0.0	ABFB016
MXP11332	OHM-P11-33	30-nov-1993	CGW	2.15000	2.15000	2.440	UGL	88.1	0.0	ABFB015
MXP11322	OHM-P11-32	30-nov-1993	CGW	1.77000	1.77000	2.000	UGL	88.5	0.0	ABFB014
MXP11EH2	EHA3	30-nov-1993	CGW	1.89000	1.89000	2.000	UGL	94.5	0.0	ABFB013
MXP11012	E3-P11-M01	30-nov-1993	CGW	1.55000	1.55000	2.000	UGL	77.5	0.0	ABFB012
MXP11A22	ATEC-2	30-nov-1993	CGW	1.82000	1.82000	2.000	UGL	91.0	0.0	ABFB011

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

MXP11A12	ATEC-1	30-nov-1993	CGW	1.79000	1.79000	2.000	UGL	89.5	0.0	ABFB010
WXP11022	E3-P11-D02	01-dec-1993	CSW	2.10000	2.10000	2.000	UGL	105.0	0.0	ABFK019
WXP11012	E3-P11-D01	01-dec-1993	CSW	2.20000	0.43000	2.270	UGL	96.9	0.0	ABFK018
WDP11012	E3-P11-D01	01-dec-1993	CSW	2.10000	0.42000	2.250	UGL	93.3	0.0	ABFK017
DXP11042	E3-P11-D04	02-dec-1993	CSE	0.34000	0.00700	0.067	UGG	104.5	80.7	ABFS010
WXP11042	E3-P11-D04	02-dec-1993	CSW	0.99000	0.99000	2.000	UGL	49.5	0.0	ABGQ020
WXP13052	E3-P13-D05	01-dec-1993	CSW	1.73000	1.73000	2.000	UGL	86.5	0.0	ABGQ012
WXP13042	E3-P13-D04	01-dec-1993	CSW	2.05000	2.05000	2.410	UGL	85.1	0.0	ABGQ011
WXP13032	E3-P13-D03	01-dec-1993	CSW	1.65000	1.65000	2.000	UGL	82.5	0.0	ABGQ010

Analyte: DBUCLE Method: PST1 Lab: UB

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
SXP16011	E3-P16-S01	31-aug-1993	CSO	0.12000	0.11900	0.100	UGG	119.0	0.9	AEHH018
SDP16011	E3-P16-S01	31-aug-1993	CSO	0.17000	0.16800	0.100	UGG	168.0	1.1	AEHH019
SXP16021	E3-P16-S02	31-aug-1993	CSO	0.20200	0.19700	0.100	UGG	197.0	2.5	AEHH020
SXP16051	E3-P16-S05	31-aug-1993	CSO	0.10700	0.10600	0.100	UGG	106.0	0.9	AEHH021
SXP16061	E3-P16-S06	31-aug-1993	CSO	0.11000	0.10900	0.100	UGG	109.0	1.2	AEHH022
SXP16121	E3-P16-S12	01-sep-1993	CSO	0.22000	0.21400	0.100	UGG	214.0	2.6	AEIB028
SXP16111	E3-P16-S11	01-sep-1993	CSO	0.16500	0.16000	0.100	UGG	160.0	2.8	AEIB027
SXP16101	E3-P16-S10	01-sep-1993	CSO	0.11400	0.11200	0.100	UGG	112.0	1.6	AEIB026
SXP16091	E3-P16-S09	01-sep-1993	CSO	0.11000	0.10800	0.100	UGG	108.0	1.5	AEIB025
SXP16081	E3-P16-S08	01-sep-1993	CSO	0.17300	0.17100	0.100	UGG	171.0	1.3	AEIB024
SXP16071	E3-P16-S07	01-sep-1993	CSO	0.11100	0.10900	0.100	UGG	109.0	2.1	AEIB023
SXP16041	E3-P16-S04	01-sep-1993	CSO	0.13500	0.13300	0.100	UGG	133.0	1.7	AEIB022
SXP16031	E3-P16-S03	01-sep-1993	CSO	0.16700	0.16500	0.100	UGG	165.0	1.4	AEIB021
DXP11031	E3-P11-D03	15-sep-1993	CSE	0.14900	0.12200	0.100	UGG	122.0	18.0	AFOC032

Analyte: ISODR Method: PST1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
WX1301X1	E3-P13-D01	02-aug-1993	CSW	0.07700	0.07700	0.400	UGL	19.3	0.0	AAJV010
WX1301X1	E3-P13-D01	02-aug-1993	CSW	0.31100	0.31100	0.449	UGL	69.3	0.0	AAJV011
WX1301X1	E3-P13-D01	02-aug-1993	CSW	0.35800	0.35800	0.449	UGL	79.7	0.0	AAJV012
DX1301X1	E3-P13-D01	02-aug-1993	CSE	0.09700	0.00100	0.013	UGG	76.9	85.5	AAKL015
DD1301X1	E3-P13-D01	02-aug-1993	CSE	0.06100	0.00100	0.013	UGG	76.9	87.0	AAKL016
DX1302X1	E3-P13-D02	02-aug-1993	CSE	0.02000	0.00500	0.013	UGG	153.9	3.5	AAKL017
DX1101X1	E3-P11-D01	03-aug-1993	CSE	0.02100	0.00300	0.013	UGG	115.4	33.2	AAKW012
DX1102X1	E3-P11-D02	03-aug-1993	CSE	0.03300	0.00200	0.013	UGG	153.9	52.1	AAKW013
DX1303X1	E3-P13-D03	03-aug-1993	CSE	0.01600	0.00100	0.013	UGG	192.3	13.2	AAKW010
DX1304X1	E3-P13-D04	03-aug-1993	CSE	0.02400	0.00300	0.013	UGG	115.4	35.9	AAKW014
DX1305X1	E3-P13-D05	03-aug-1993	CSE	0.03400	0.00600	0.013	UGG	184.6	28.6	AAKW011
MX1101X1	E3-P11-M01	24-aug-1993	CGW	0.29600	0.29600	0.400	UGL	74.0	0.0	AARO018
MR1101X1	E3-P11-M01	24-aug-1993	CGW	0.25600	0.25600	0.400	UGL	64.0	0.0	AASG013
MD1101X1	E3-P11-M01	24-aug-1993	CGW	0.33800	0.33800	0.400	UGL	84.5	0.0	AASG012
MX1302X1	E3-P13-M02	24-aug-1993	CGW	0.35900	0.35900	0.400	UGL	89.8	0.0	AASG010
MX1304X1	E3-P13-M04	24-aug-1993	CGW	0.22300	0.22300	0.400	UGL	55.8	0.0	AASG011
MX1301X1	E3-P13-M01	25-aug-1993	CGW	0.38000	0.09500	0.400	UGL	95.0	0.0	AASO014
MX1301X1	E3-P13-M01	25-aug-1993	CGW	0.36000	0.09000	0.400	UGL	90.0	0.0	AASO019
MX1301X1	E3-P13-M01	25-aug-1993	CGW	0.39000	0.09800	0.400	UGL	97.5	0.0	AASO020
MX1303X1	E3-P13-M03	25-aug-1993	CGW	0.33000	0.08200	0.400	UGL	82.5	0.0	AASO012

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

MX1132X1	OHM-P11-32	25-aug-1993	CGW	0.13700	0.13700	0.400	UGL	34.3	0.0	AASO010
MX1133X1	OHM-P11-33	25-aug-1993	CGW	0.25000	0.06300	0.400	UGL	62.5	0.0	AASO011
MXP11A11	ATEC-1	02-sep-1993	CGW	0.30600	0.30600	0.400	UGL	76.5	0.0	AAUJ019
MXP11A21	ATEC-2	02-sep-1993	CGW	0.31000	0.31000	0.400	UGL	77.5	0.0	AAUJ020
WXP11031	E3-P11-D03	15-sep-1993	CSW	0.30500	0.30500	0.400	UGL	76.3	0.0	AAYT013
MXP13022	E3-P13-M02	30-nov-1993	CGW	0.40700	0.40700	0.400	UGL	101.8	0.0	ABFB022
MXP13022	E3-P13-M02	30-nov-1993	CGW	0.34000	0.34000	0.400	UGL	85.0	0.0	ABFB021
MXP13042	E3-P13-M04	29-nov-1993	CGW	0.42600	0.42600	0.400	UGL	106.5	0.0	ABFB020
MXP13012	E3-P13-M01	29-nov-1993	CGW	0.35900	0.35900	0.400	UGL	89.8	0.0	ABFB019
MXP13022	E3-P13-M02	30-nov-1993	CGW	0.35600	0.35600	0.400	UGL	89.0	0.0	ABFB018
MRP11012	E3-P11-M01	30-nov-1993	CGW	0.33800	0.33800	0.400	UGL	84.5	0.0	ABFB017
MXP13032	E3-P13-M03	30-nov-1993	CGW	0.29600	0.29600	0.400	UGL	74.0	0.0	ABFB016
MXP11332	OHM-P11-33	30-nov-1993	CGW	0.47300	0.47300	0.488	UGL	96.9	0.0	ABFB015
MXP11322	OHM-P11-32	30-nov-1993	CGW	0.34100	0.34100	0.400	UGL	85.3	0.0	ABFB014
MXP11EH2	EHA3	30-nov-1993	CGW	0.36100	0.36100	0.400	UGL	90.3	0.0	ABFB013
MXP11012	E3-P11-M01	30-nov-1993	CGW	0.32500	0.32500	0.400	UGL	81.3	0.0	ABFB012
MXP11A22	ATEC-2	30-nov-1993	CGW	0.33000	0.33000	0.400	UGL	82.5	0.0	ABFB011
MXP11A12	ATEC-1	30-nov-1993	CGW	0.35500	0.35500	0.400	UGL	88.8	0.0	ABFB010
WXP11022	E3-P11-D02	01-dec-1993	CSW	0.39500	0.39500	0.400	UGL	98.8	0.0	ABFK019
WXP11012	E3-P11-D01	01-dec-1993	CSW	0.48000	0.09700	0.455	UGL	105.5	0.0	ABFK018
WDP11012	E3-P11-D01	01-dec-1993	CSW	0.44000	0.08800	0.449	UGL	98.0	0.0	ABFK017
DXP11042	E3-P11-D04	02-dec-1993	CSE	0.07300	0.00100	0.013	UGG	76.9	80.7	ABFS010
WXP11042	E3-P11-D04	02-dec-1993	CSW	0.17900	0.17900	0.400	UGL	44.8	0.0	ABGQ020
WXP13052	E3-P13-D05	01-dec-1993	CSW	0.28800	0.28800	0.400	UGL	72.0	0.0	ABGQ012
WXP13042	E3-P13-D04	01-dec-1993	CSW	0.36800	0.36800	0.482	UGL	76.4	0.0	ABGQ011
WXP13032	E3-P13-D03	01-dec-1993	CSW	0.28200	0.28200	0.400	UGL	70.5	0.0	ABGQ010

Analyte: MEC6D8 Method: VMS1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
DD1301X1	E3-P13-D01	02-aug-1993	CSE	0.55000	0.07200	0.049	UGG	146.9	87.0	AAJY009
DX1301X1	E3-P13-D01	02-aug-1993	CSE	0.50000	0.07200	0.050	UGG	144.0	85.5	AAJY008
DX1302X1	E3-P13-D02	02-aug-1993	CSE	0.05300	0.05200	0.050	UGG	104.0	3.5	AAJY010
DV1101X1	E3-P11-D01	03-aug-1993	CSE	50.00000	49.90000	50.000	UGL	100.0	0.0	AAKS008
WX1301X1	E3-P13-D01	02-aug-1993	CSW	51.00000	51.20000	50.000	UGL	102.0	0.0	AAKS003
DV1301X1	E3-P13-D01	02-aug-1993	CSE	51.00000	50.50000	50.000	UGL	102.0	0.0	AAKS004
WV1301X1	E3-P13-D01	02-aug-1993	CSW	50.00000	50.10000	50.000	UGL	100.0	0.0	AAKS005
DX1101X1	E3-P11-D01	03-aug-1993	CSE	0.09400	0.06300	0.050	UGG	126.0	33.2	AAKT005
DX1102X1	E3-P11-D02	03-aug-1993	CSE	0.13000	0.06300	0.049	UGG	128.6	52.1	AAKT006
DX1303X1	E3-P13-D03	03-aug-1993	CSE	0.05700	0.05000	0.049	UGG	102.0	13.2	AAKT003
DX1304X1	E3-P13-D04	03-aug-1993	CSE	0.08400	0.05400	0.050	UGG	108.0	35.9	AAKT007
DX1305X1	E3-P13-D05	03-aug-1993	CSE	0.07400	0.05300	0.048	UGG	110.4	28.6	AAKT004
MR1101X1	E3-P11-M01	24-aug-1993	CGW	50.00000	49.70000	50.000	UGL	100.0	0.0	AASA008
MX1101X1	E3-P11-M01	24-aug-1993	CGW	50.00000	49.90000	50.000	UGL	100.0	0.0	AASA004
MD1101X1	E3-P11-M01	24-aug-1993	CGW	51.00000	50.70000	50.000	UGL	102.0	0.0	AASA007
MX1302X1	E3-P13-M02	24-aug-1993	CGW	51.00000	51.10000	50.000	UGL	102.0	0.0	AASA005
MX1303X1	E3-P13-M03	25-aug-1993	CGW	51.00000	51.00000	50.000	UGL	102.0	0.0	AASA014
MX1304X1	E3-P13-M04	24-aug-1993	CGW	53.00000	52.50000	50.000	UGL	106.0	0.0	AASA006
MX1132X1	OHM-P11-32	25-aug-1993	CGW	50.00000	50.40000	50.000	UGL	100.0	0.0	AASA012
MX1133X1	OHM-P11-33	25-aug-1993	CGW	51.00000	50.70000	50.000	UGL	102.0	0.0	AASA013
MV1302X1	E3-P13-M01	25-aug-1993	CGW	49.00000	48.50000	50.000	UGL	98.0	0.0	AASN006

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

MX1301X1	E3-P13-M01	25-aug-1993	CGW	50.00000	49.60000	50.000	UGL	100.0	0.0	AASN012
MX1301X1	E3-P13-M01	25-aug-1993	CGW	50.00000	50.40000	50.000	UGL	100.0	0.0	AASN013
MX1301X1	E3-P13-M01	25-aug-1993	CGW	50.00000	49.60000	50.000	UGL	100.0	0.0	AASN014
SXP16011	E3-P16-S01	31-aug-1993	CSO	0.05300	0.05200	0.049	UGG	106.1	1.0	AATH011
SDP16011	E3-P16-S01	31-aug-1993	CSO	0.06400	0.06300	0.051	UGG	123.5	1.2	AATH012
SXP16021	E3-P16-S02	31-aug-1993	CSO	0.06400	0.06300	0.052	UGG	121.2	1.8	AATH013
SXP16051	E3-P16-S05	31-aug-1993	CSO	0.05300	0.05200	0.050	UGG	104.0	1.4	AATH014
SXP16061	E3-P16-S06	31-aug-1993	CSO	0.04500	0.04500	0.048	UGG	93.8	1.2	AATI003
SXP16031	E3-P16-S03	01-sep-1993	CSO	0.04400	0.04300	0.049	UGG	87.8	2.2	AATK005
SXP16041	E3-P16-S04	01-sep-1993	CSO	0.06000	0.05900	0.053	UGG	111.3	2.3	AATK006
SXP16071	E3-P16-S07	01-sep-1993	CSO	0.04900	0.04800	0.049	UGG	98.0	1.4	AATK007
SXP16081	E3-P16-S08	01-sep-1993	CSO	0.04500	0.04400	0.049	UGG	89.8	1.9	AATK008
SXP16091	E3-P16-S09	01-sep-1993	CSO	0.05200	0.05100	0.047	UGG	108.5	1.7	AATK009
SXP16101	E3-P16-S10	01-sep-1993	CSO	0.04600	0.04500	0.048	UGG	93.8	1.9	AATK010
SXP16111	E3-P16-S11	01-sep-1993	CSO	0.05000	0.04800	0.048	UGG	100.0	3.1	AATK011
SXP16121	E3-P16-S12	01-sep-1993	CSO	0.04200	0.04100	0.045	UGG	91.1	2.7	AATK012
SVP16011	E3-P16-S01	01-sep-1993	CSO	50.00000	49.70000	50.000	UGL	100.0	0.0	AATV005
MXP11A11	ATEC-1	02-sep-1993	CGW	50.00000	49.80000	50.000	UGL	100.0	0.0	AATX005
MXP11A21	ATEC-2	02-sep-1993	CGW	49.00000	49.40000	50.000	UGL	98.0	0.0	AATX006
WXP11031	E3-P11-D03	15-sep-1993	CSW	50.00000	50.00000	50.000	UGL	100.0	0.0	AAYB007
DXP11031	E3-P11-D03	15-sep-1993	CSE	0.07100	0.05200	0.050	UGG	104.0	26.8	AAYM005
MRP11012	E3-P11-M01	30-nov-1993	CGW	50.00000	49.70000	50.000	UGL	100.0	0.0	ABGX013
MVP13012	E3-P13-M01	29-nov-1993	CGW	52.00000	51.80000	50.000	UGL	104.0	0.0	ABGX005
MXP11A12	ATEC-1	30-nov-1993	CGW	51.00000	50.60000	50.000	UGL	102.0	0.0	ABGX006
MXP11A22	ATEC-2	30-nov-1993	CGW	49.00000	49.10000	50.000	UGL	98.0	0.0	ABGX007
MXP11012	E3-P11-M01	30-nov-1993	CGW	49.00000	49.30000	50.000	UGL	98.0	0.0	ABGX008
MXP13012	E3-P13-M01	29-nov-1993	CGW	51.00000	50.70000	50.000	UGL	102.0	0.0	ABGX003
MXP13032	E3-P13-M03	30-nov-1993	CGW	51.00000	51.20000	50.000	UGL	102.0	0.0	ABGX012
MXP13042	E3-P13-M04	29-nov-1993	CGW	51.00000	50.90000	50.000	UGL	102.0	0.0	ABGX004
MXP11EH2	EHA3	30-nov-1993	CGW	50.00000	49.60000	50.000	UGL	100.0	0.0	ABGX009
MXP11322	OHM-P11-32	30-nov-1993	CGW	50.00000	49.60000	50.000	UGL	100.0	0.0	ABGX010
MXP11332	OHM-P11-33	30-nov-1993	CGW	50.00000	49.50000	50.000	UGL	100.0	0.0	ABGX011
WDP11012	E3-P11-D01	01-dec-1993	CSW	50.00000	50.30000	50.000	UGL	100.0	0.0	ABGY013
MVP11012	E3-P11-M01	30-nov-1993	CGW	52.00000	52.30000	50.000	UGL	104.0	0.0	ABGY005
MXP13022	E3-P13-M02	30-nov-1993	CGW	53.00000	53.40000	50.000	UGL	106.0	0.0	ABGY003
WXP13052	E3-P13-D05	01-dec-1993	CSW	50.00000	50.00000	50.000	UGL	100.0	0.0	ABGZ007
WXP13042	E3-P13-D04	01-dec-1993	CSW	50.00000	49.60000	50.000	UGL	100.0	0.0	ABGZ006
WXP13032	E3-P13-D03	01-dec-1993	CSW	50.00000	49.70000	50.000	UGL	100.0	0.0	ABGZ005
WXP11022	E3-P11-D02	01-dec-1993	CSW	51.00000	50.90000	50.000	UGL	102.0	0.0	ABGZ004
WXP11012	E3-P11-D01	01-dec-1993	CSW	51.00000	51.00000	50.000	UGL	102.0	0.0	ABGZ003
WXP11042	E3-P11-D04	02-dec-1993	CSW	47.00000	47.00000	50.000	UGL	94.0	0.0	ABHA006
DXP11042	E3-P11-D04	02-dec-1993	CSE	0.30000	0.05700	0.048	UGG	118.8	80.7	ABHB010

Analyte: NBD5 Method: SMV1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
DX1301X1	E3-P13-D01	02-aug-1993	CSE	7.00000	0.20000	1.700	UGG	58.8	85.5	AAKM008
DD1301X1	E3-P13-D01	02-aug-1993	CSE	5.00000	0.14000	1.700	UGG	41.2	87.0	AAKM009
DX1302X1	E3-P13-D02	02-aug-1993	CSE	0.62000	0.59700	1.670	UGG	35.8	3.5	AAKM010
WX1301X1	E3-P13-D01	02-aug-1993	CSW	81.00000	81.20000	100.000	UGL	81.0	0.0	AAKO003
DX1101X1	E3-P11-D01	03-aug-1993	CSE	2.00000	0.21000	1.700	UGG	61.8	33.2	AAKU005

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

DX1102X1	E3-P11-D02	03-aug-1993	CSE	2.00000	0.94000	1.670	UGG	56.3	52.1	AAKU006
DX1303X1	E3-P13-D03	03-aug-1993	CSE	1.00000	0.24000	1.700	UGG	70.6	13.2	AAKU003
DX1304X1	E3-P13-D04	03-aug-1993	CSE	1.20000	0.78100	1.670	UGG	46.8	35.9	AAKU007
DX1305X1	E3-P13-D05	03-aug-1993	CSE	1.10000	0.80400	1.670	UGG	48.1	28.6	AAKU004
SXP16011	E3-P16-S01	31-aug-1993	CSO	0.93000	0.91800	1.670	UGG	55.0	1.0	AATA003
SDP16011	E3-P16-S01	31-aug-1993	CSO	0.68000	0.67200	1.670	UGG	40.2	1.2	AATA004
SXP16021	E3-P16-S02	31-aug-1993	CSO	0.86000	0.84200	1.670	UGG	50.4	1.8	AATA005
SXP16051	E3-P16-S05	31-aug-1993	CSO	0.49000	0.47900	1.670	UGG	28.7	1.4	AATA006
SXP16061	E3-P16-S06	31-aug-1993	CSO	0.50000	0.49400	1.670	UGG	29.6	1.2	AATA007
SXP16031	E3-P16-S03	01-sep-1993	CSO	0.78000	0.76600	1.670	UGG	45.9	2.2	AATQ003
SXP16041	E3-P16-S04	01-sep-1993	CSO	0.93000	0.90800	1.670	UGG	54.4	2.3	AATQ004
SXP16071	E3-P16-S07	01-sep-1993	CSO	0.53000	0.52600	1.670	UGG	31.5	1.4	AATQ005
SXP16081	E3-P16-S08	01-sep-1993	CSO	0.70000	0.68800	1.670	UGG	41.2	1.9	AATQ006
SXP16091	E3-P16-S09	01-sep-1993	CSO	0.72000	0.70500	1.670	UGG	42.2	1.7	AATQ007
SXP16101	E3-P16-S10	01-sep-1993	CSO	0.15000	0.15000	1.670	UGG	9.0	1.9	AATQ008
SXP16111	E3-P16-S11	01-sep-1993	CSO	0.79000	0.77000	1.670	UGG	46.1	3.1	AATQ009
SXP16121	E3-P16-S12	01-sep-1993	CSO	0.85000	0.82800	1.670	UGG	49.6	2.7	AATQ010
MXP11A11	ATEC-1	02-sep-1993	CGW	60.00000	60.30000	100.000	UGL	60.0	0.0	AAUF012
MXP11A21	ATEC-2	02-sep-1993	CGW	65.00000	65.10000	100.000	UGL	65.0	0.0	AAUF013
DXP11031	E3-P11-D03	15-sep-1993	CSE	2.00000	1.46000	1.670	UGG	87.4	26.8	AAYP006
WXP11031	E3-P11-D03	15-sep-1993	CSW	70.00000	70.40000	100.000	UGL	70.0	0.0	AAYQ006
MRP11012	E3-P11-M01	30-nov-1993	CGW	76.00000	75.50000	100.000	UGL	76.0	0.0	ABFC010
MXP11A12	ATEC-1	30-nov-1993	CGW	70.00000	69.70000	114.000	UGL	61.4	0.0	ABFC003
MXP11A22	ATEC-2	30-nov-1993	CGW	88.00000	88.40000	100.000	UGL	88.0	0.0	ABFC004
MXP11012	E3-P11-M01	30-nov-1993	CGW	90.00000	90.00000	100.000	UGL	90.0	0.0	ABFC005
MXP13022	E3-P13-M02	30-nov-1993	CGW	93.00000	92.90000	100.000	UGL	93.0	0.0	ABFC011
MXP13032	E3-P13-M03	30-nov-1993	CGW	75.00000	75.40000	100.000	UGL	75.0	0.0	ABFC009
MXP11EH2	EHA3	30-nov-1993	CGW	85.00000	84.70000	100.000	UGL	85.0	0.0	ABFC006
MXP11322	OHM-P11-32	30-nov-1993	CGW	74.00000	74.30000	100.000	UGL	74.0	0.0	ABFC007
MXP11332	OHM-P11-33	30-nov-1993	CGW	94.00000	93.50000	122.000	UGL	77.1	0.0	ABFC008
MXP13012	E3-P13-M01	29-nov-1993	CGW	76.00000	76.40000	100.000	UGL	76.0	0.0	ABFN003
MXP13042	E3-P13-M04	29-nov-1993	CGW	79.00000	78.80000	100.000	UGL	79.0	0.0	ABFN004
SDP16102	E3-P16-S10	01-dec-1993	CSO	1.20000	1.06000	1.670	UGG	63.5	8.6	ABFT007
SXP16102	E3-P16-S10	01-dec-1993	CSO	1.20000	1.12000	1.670	UGG	67.1	6.4	ABFT008
WDP11012	E3-P11-D01	01-dec-1993	CSW	67.00000	67.30000	100.000	UGL	67.0	0.0	ABFV010
WXP11012	E3-P11-D01	01-dec-1993	CSW	65.00000	64.60000	100.000	UGL	65.0	0.0	ABFV011
WXP11022	E3-P11-D02	01-dec-1993	CSW	93.00000	93.20000	127.000	UGL	73.2	0.0	ABFV012
WXP13032	E3-P13-D03	01-dec-1993	CSW	77.00000	77.20000	100.000	UGL	77.0	0.0	ABFV013
WXP13042	E3-P13-D04	01-dec-1993	CSW	91.00000	90.50000	112.000	UGL	81.3	0.0	ABFV014
DXP11042	E3-P11-D04	02-dec-1993	CSE	7.60000	1.46000	1.670	UGG	87.4	80.7	ABGL004
WXP11042	E3-P11-D04	02-dec-1993	CSW	83.00000	82.60000	112.000	UGL	74.1	0.0	ABGM013
WXP13052	E3-P13-D05	01-dec-1993	CSW	84.00000	84.40000	116.000	UGL	72.4	0.0	ABGM003

Analyte: PHEND5 Method: SMV1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
DX1301X1	E3-P13-D01	02-aug-1993	CSE	5.00000	0.14000	1.700	UGG	41.2	85.5	AAKM008
DD1301X1	E3-P13-D01	02-aug-1993	CSE	8.00000	0.20000	1.700	UGG	58.8	87.0	AAKM009
DX1302X1	E3-P13-D02	02-aug-1993	CSE	1.10000	1.03000	1.670	UGG	61.7	3.5	AAKM010
WX1301X1	E3-P13-D01	02-aug-1993	CSW	37.00000	36.50000	100.000	UGL	37.0	0.0	AAKO003
DX1101X1	E3-P11-D01	03-aug-1993	CSE	1.00000	0.20000	1.700	UGG	58.8	33.2	AAKU005

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

DX1102X1	E3-P11-D02	03-aug-1993	CSE	2.10000	0.99700	1.670	UGG	59.7	52.1	AAKU006
DX1303X1	E3-P13-D03	03-aug-1993	CSE	1.00000	0.24000	1.700	UGG	70.6	13.2	AAKU003
DX1304X1	E3-P13-D04	03-aug-1993	CSE	1.60000	1.04000	1.670	UGG	62.3	35.9	AAKU007
DX1305X1	E3-P13-D05	03-aug-1993	CSE	1.30000	0.90200	1.670	UGG	54.0	28.6	AAKU004
SXP16011	E3-P16-S01	31-aug-1993	CSO	0.97000	0.96000	1.670	UGG	57.5	1.0	AATA003
SDP16011	E3-P16-S01	31-aug-1993	CSO	0.79000	0.78000	1.670	UGG	46.7	1.2	AATA004
SXP16021	E3-P16-S02	31-aug-1993	CSO	0.87000	0.85200	1.670	UGG	51.0	1.8	AATA005
SXP16051	E3-P16-S05	31-aug-1993	CSO	0.65000	0.64200	1.670	UGG	38.4	1.4	AATA006
SXP16061	E3-P16-S06	31-aug-1993	CSO	0.62000	0.61200	1.670	UGG	36.7	1.2	AATA007
SXP16031	E3-P16-S03	01-sep-1993	CSO	1.00000	1.02000	1.670	UGG	61.1	2.2	AATQ003
SXP16041	E3-P16-S04	01-sep-1993	CSO	1.10000	1.05000	1.670	UGG	62.9	2.3	AATQ004
SXP16071	E3-P16-S07	01-sep-1993	CSO	0.56000	0.55000	1.670	UGG	32.9	1.4	AATQ005
SXP16081	E3-P16-S08	01-sep-1993	CSO	0.84000	0.82400	1.670	UGG	49.3	1.9	AATQ006
SXP16091	E3-P16-S09	01-sep-1993	CSO	0.95000	0.93500	1.670	UGG	56.0	1.7	AATQ007
SXP16101	E3-P16-S10	01-sep-1993	CSO	0.97000	0.95600	1.670	UGG	57.3	1.9	AATQ008
SXP16111	E3-P16-S11	01-sep-1993	CSO	1.00000	1.01000	1.670	UGG	60.5	3.1	AATQ009
SXP16121	E3-P16-S12	01-sep-1993	CSO	1.20000	1.12000	1.670	UGG	67.1	2.7	AATQ010
MXP11A11	ATEC-1	02-sep-1993	CGW	29.00000	29.20000	100.000	UGL	29.0	0.0	AAUF012
MXP11A21	ATEC-2	02-sep-1993	CGW	28.00000	27.70000	100.000	UGL	28.0	0.0	AAUF013
DXP11031	E3-P11-D03	15-sep-1993	CSE	1.80000	1.30000	1.670	UGG	77.8	26.8	AAYP006
WXP11031	E3-P11-D03	15-sep-1993	CSW	26.00000	26.40000	100.000	UGL	26.0	0.0	AAYQ006
MRP11012	E3-P11-M01	30-nov-1993	CGW	35.00000	34.90000	100.000	UGL	35.0	0.0	ABFC010
MXP11A12	ATEC-1	30-nov-1993	CGW	38.00000	37.90000	114.000	UGL	33.3	0.0	ABFC003
MXP11A22	ATEC-2	30-nov-1993	CGW	30.00000	29.50000	100.000	UGL	30.0	0.0	ABFC004
MXP11012	E3-P11-M01	30-nov-1993	CGW	28.00000	28.20000	100.000	UGL	28.0	0.0	ABFC005
MXP13022	E3-P13-M02	30-nov-1993	CGW	32.00000	31.90000	100.000	UGL	32.0	0.0	ABFC011
MXP13032	E3-P13-M03	30-nov-1993	CGW	32.00000	32.00000	100.000	UGL	32.0	0.0	ABFC009
MXP11EH2	EHA3	30-nov-1993	CGW	31.00000	31.20000	100.000	UGL	31.0	0.0	ABFC006
MXP11322	OHM-P11-32	30-nov-1993	CGW	34.00000	34.00000	100.000	UGL	34.0	0.0	ABFC007
MXP11332	OHM-P11-33	30-nov-1993	CGW	32.00000	32.30000	122.000	UGL	26.2	0.0	ABFC008
MXP13012	E3-P13-M01	29-nov-1993	CGW	34.00000	33.50000	100.000	UGL	34.0	0.0	ABFN003
MXP13042	E3-P13-M04	29-nov-1993	CGW	31.00000	31.20000	100.000	UGL	31.0	0.0	ABFN004
SDP16102	E3-P16-S10	01-dec-1993	CSO	1.20000	1.11000	1.670	UGG	66.5	8.6	ABFT007
SXP16102	E3-P16-S10	01-dec-1993	CSO	1.20000	1.15000	1.670	UGG	68.9	6.4	ABFT008
WDP11012	E3-P11-D01	01-dec-1993	CSW	29.00000	28.70000	100.000	UGL	29.0	0.0	ABFV010
WXP11012	E3-P11-D01	01-dec-1993	CSW	34.00000	34.40000	100.000	UGL	34.0	0.0	ABFV011
WXP11022	E3-P11-D02	01-dec-1993	CSW	41.00000	40.50000	127.000	UGL	32.3	0.0	ABFV012
WXP13032	E3-P13-D03	01-dec-1993	CSW	33.00000	32.80000	100.000	UGL	33.0	0.0	ABFV013
WXP13042	E3-P13-D04	01-dec-1993	CSW	30.00000	29.50000	112.000	UGL	26.8	0.0	ABFV014
DXP11042	E3-P11-D04	02-dec-1993	CSE	7.50000	1.44000	1.670	UGG	86.2	80.7	ABGL004
WXP11042	E3-P11-D04	02-dec-1993	CSW	8.80000	8.82000	112.000	UGL	7.9	0.0	ABGM013
WXP13052	E3-P13-D05	01-dec-1993	CSW	26.00000	25.60000	116.000	UGL	22.4	0.0	ABGM003

Analyte: TRPD14 Method: SMV1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
DX1301X1	E3-P13-D01	02-aug-1993	CSE	10.00000	0.33000	1.700	UGG	97.1	85.5	AAKM008
DD1301X1	E3-P13-D01	02-aug-1993	CSE	10.00000	0.28000	1.700	UGG	82.4	87.0	AAKM009
DX1302X1	E3-P13-D02	02-aug-1993	CSE	1.30000	1.30000	1.670	UGG	77.8	3.5	AAKM010
WX1301X1	E3-P13-D01	02-aug-1993	CSW	90.00000	89.90000	100.000	UGL	90.0	0.0	AAKO003
DX1101X1	E3-P11-D01	03-aug-1993	CSE	2.00000	0.25000	1.700	UGG	73.5	33.2	AAKU005

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

DX1102X1	E3-P11-D02	03-aug-1993	CSE	2.30000	1.10000	1.670	UGG	65.9	52.1	AAKU006
DX1303X1	E3-P13-D03	03-aug-1993	CSE	2.00000	0.29000	1.700	UGG	85.3	13.2	AAKU003
DX1304X1	E3-P13-D04	03-aug-1993	CSE	1.80000	1.14000	1.670	UGG	68.3	35.9	AAKU007
DX1305X1	E3-P13-D05	03-aug-1993	CSE	1.30000	0.93000	1.670	UGG	55.7	28.6	AAKU004
SXP16011	E3-P16-S01	31-aug-1993	CSO	1.30000	1.28000	1.670	UGG	76.7	1.0	AATA003
SDP16011	E3-P16-S01	31-aug-1993	CSO	1.30000	1.24000	1.670	UGG	74.3	1.2	AATA004
SXP16021	E3-P16-S02	31-aug-1993	CSO	0.99000	0.97600	1.670	UGG	58.4	1.8	AATA005
SXP16051	E3-P16-S05	31-aug-1993	CSO	1.20000	1.22000	1.670	UGG	73.1	1.4	AATA006
SXP16061	E3-P16-S06	31-aug-1993	CSO	1.20000	1.20000	1.670	UGG	71.9	1.2	AATA007
SXP16031	E3-P16-S03	01-sep-1993	CSO	1.20000	1.14000	1.670	UGG	68.3	2.2	AATQ003
SXP16041	E3-P16-S04	01-sep-1993	CSO	1.10000	1.04000	1.670	UGG	62.3	2.3	AATQ004
SXP16071	E3-P16-S07	01-sep-1993	CSO	0.66000	0.64800	1.670	UGG	38.8	1.4	AATQ005
SXP16081	E3-P16-S08	01-sep-1993	CSO	1.20000	1.17000	1.670	UGG	70.1	1.9	AATQ006
SXP16091	E3-P16-S09	01-sep-1993	CSO	1.30000	1.25000	1.670	UGG	74.9	1.7	AATQ007
SXP16101	E3-P16-S10	01-sep-1993	CSO	0.01700	0.01600	1.670	UGG	1.0	1.9	AATQ008
SXP16111	E3-P16-S11	01-sep-1993	CSO	1.80000	1.77000	1.670	UGG	106.0	3.1	AATQ009
SXP16121	E3-P16-S12	01-sep-1993	CSO	2.00000	1.92000	1.670	UGG	115.0	2.7	AATQ010
MXP11A11	ATEC-1	02-sep-1993	CGW	67.00000	66.60000	100.000	UGL	67.0	0.0	AAUF012
MXP11A21	ATEC-2	02-sep-1993	CGW	66.00000	66.00000	100.000	UGL	66.0	0.0	AAUF013
DXP11031	E3-P11-D03	15-sep-1993	CSE	1.90000	1.41000	1.670	UGG	84.4	26.8	AAYP006
WXP11031	E3-P11-D03	15-sep-1993	CSW	69.00000	68.70000	100.000	UGL	69.0	0.0	AAYQ006
MRP11012	E3-P11-M01	30-nov-1993	CGW	120.00000	116.00000	100.000	UGL	120.0	0.0	ABFC010
MXP11A12	ATEC-1	30-nov-1993	CGW	120.00000	123.00000	114.000	UGL	105.3	0.0	ABFC003
MXP11A22	ATEC-2	30-nov-1993	CGW	120.00000	122.00000	100.000	UGL	120.0	0.0	ABFC004
MXP11012	E3-P11-M01	30-nov-1993	CGW	110.00000	114.00000	100.000	UGL	110.0	0.0	ABFC005
MXP13022	E3-P13-M02	30-nov-1993	CGW	120.00000	119.00000	100.000	UGL	120.0	0.0	ABFC011
MXP13032	E3-P13-M03	30-nov-1993	CGW	89.00000	88.50000	100.000	UGL	89.0	0.0	ABFC009
MXP11EH2	EHA3	30-nov-1993	CGW	130.00000	126.00000	100.000	UGL	130.0	0.0	ABFC006
MXP11322	OHM-P11-32	30-nov-1993	CGW	110.00000	109.00000	100.000	UGL	110.0	0.0	ABFC007
MXP11332	OHM-P11-33	30-nov-1993	CGW	140.00000	138.00000	122.000	UGL	114.8	0.0	ABFC008
MXP13012	E3-P13-M01	29-nov-1993	CGW	88.00000	88.40000	100.000	UGL	88.0	0.0	ABFN003
MXP13042	E3-P13-M04	29-nov-1993	CGW	96.00000	96.00000	100.000	UGL	96.0	0.0	ABFN004
SDP16102	E3-P16-S10	01-dec-1993	CSO	1.30000	1.22000	1.670	UGG	73.1	8.6	ABFT007
SXP16102	E3-P16-S10	01-dec-1993	CSO	1.30000	1.19000	1.670	UGG	71.3	6.4	ABFT008
WDP11012	E3-P11-D01	01-dec-1993	CSW	100.00000	103.00000	100.000	UGL	100.0	0.0	ABFV010
WXP11012	E3-P11-D01	01-dec-1993	CSW	98.00000	98.30000	100.000	UGL	98.0	0.0	ABFV011
WXP11022	E3-P11-D02	01-dec-1993	CSW	120.00000	121.00000	127.000	UGL	94.5	0.0	ABFV012
WXP13032	E3-P13-D03	01-dec-1993	CSW	110.00000	109.00000	100.000	UGL	110.0	0.0	ABFV013
WXP13042	E3-P13-D04	01-dec-1993	CSW	130.00000	131.00000	112.000	UGL	116.1	0.0	ABFV014
DXP11042	E3-P11-D04	02-dec-1993	CSE	8.40000	1.62000	1.670	UGG	97.0	80.7	ABGL004
WXP11042	E3-P11-D04	02-dec-1993	CSW	100.00000	104.00000	112.000	UGL	89.3	0.0	ABGM013
WXP13052	E3-P13-D05	01-dec-1993	CSW	110.00000	110.00000	116.000	UGL	94.8	0.0	ABGM003

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

Table F-7 Surrogate Recoveries

Study Area: P3

Analyte: 12DBD4 Method: SMV1 Lab: UB

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
EXP31011	E3-P31-B01	24-sep-1993	CSO	3.40000	3.10000	3.300	UGG	93.9	9.0	AEYZ003
EXP31012	E3-P31-B01	24-sep-1993	CSO	2.60000	2.50000	3.300	UGG	75.8	4.7	AEYZ004
EDP31012	E3-P31-B01	24-sep-1993	CSO	3.30000	3.10000	3.300	UGG	93.9	6.3	AEYZ005
EXP31021	E3-P31-B02	24-sep-1993	CSO	3.40000	3.10000	3.300	UGG	93.9	8.8	AEYZ006
EXP31022	E3-P31-B02	24-sep-1993	CSO	3.20000	3.00000	3.300	UGG	90.9	7.5	AEYZ007
EXP31031	E3-P31-B03	24-sep-1993	CSO	4.40000	3.10000	3.300	UGG	93.9	29.4	AEYZ008
EXP38011	E3-P38-B01	24-sep-1993	CSO	3.30000	3.10000	3.300	UGG	93.9	5.5	AEYZ009
EXP38012	E3-P38-B01	24-sep-1993	CSO	3.20000	2.90000	3.300	UGG	87.9	10.4	AEYZ010
EXP38021	E3-P38-B02	24-sep-1993	CSO	2.90000	2.80000	3.300	UGG	84.9	4.6	AEYZ011
EXP38022	E3-P38-B02	24-sep-1993	CSO	3.10000	2.90000	3.300	UGG	87.9	5.2	AEYZ012

Analyte: 12DCD4 Method: VMS1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
BX360102	E3-P36-B01	05-aug-1993	CSO	0.05200	0.04800	0.047	UGG	102.1	8.6	AALG008
BX360101	E3-P36-B01	05-aug-1993	CSO	0.05600	0.05200	0.050	UGG	104.0	7.3	AALG007
BX360201	E3-P36-B02	05-aug-1993	CSO	0.05600	0.05200	0.050	UGG	104.0	6.8	AALG009
BX360202	E3-P36-B02	05-aug-1993	CSO	0.05700	0.05100	0.050	UGG	102.0	10.7	AALG010
BX370102	E3-P37-B01	09-aug-1993	CSO	0.07400	0.05600	0.049	UGG	114.3	23.3	AAMR007
BX370101	E3-P37-B01	09-aug-1993	CSO	0.06500	0.05000	0.050	UGG	100.0	22.3	AAMR008
BX370201	E3-P37-B02	06-aug-1993	CSO	0.05300	0.05000	0.049	UGG	102.0	4.9	AAMR003
BX370202	E3-P37-B02	06-aug-1993	CSO	0.07100	0.05300	0.050	UGG	106.0	25.7	AAMR004
BR3701X1	E3-P37-B02	09-aug-1993	CSO	43.00000	42.90000	50.000	UGL	86.0	0.0	AAMS004
BV3701X1	E3-P37-D02	06-aug-1993	CSO	43.00000	42.90000	50.000	UGL	86.0	0.0	AAMS003
BV3702X1	E3-P37-B01	09-aug-1993	CSO	47.00000	46.80000	50.000	UGL	94.0	0.0	AAMS006
BX380101	E3-P38-B04	10-aug-1993	CSO	0.05400	0.05100	0.050	UGG	102.0	6.2	AANX003
BX380102	E3-P38-B04	10-aug-1993	CSO	0.06500	0.05100	0.051	UGG	100.0	22.7	AANX004
DX3902X1	E3-P39-D02	11-aug-1993	CSE	0.20000	0.04800	0.049	UGG	98.0	76.2	AANY008
DX3903X1	E3-P39-D03	11-aug-1993	CSE	0.26000	0.05800	0.050	UGG	116.0	77.9	AANY009
DX3904X1	E3-P39-D04	11-aug-1993	CSE	0.23000	0.05300	0.049	UGG	108.2	77.5	AANY010
DX3905X1	E3-P39-D05	11-aug-1993	CSE	0.25000	0.05200	0.047	UGG	110.6	78.8	AANY011
DX3906X1	E3-P39-D06	11-aug-1993	CSE	0.25000	0.05600	0.052	UGG	107.7	77.2	AANY012
BV3801X1	E3-P38-B04	10-aug-1993	CSO	49.00000	48.90000	50.000	UGL	98.0	0.0	AANZ006
BR3801X1	E3-P38-B04	10-aug-1993	CSO	49.00000	48.80000	50.000	UGL	98.0	0.0	AANZ003
BV3602X1	E3-P36-B03	13-aug-1993	CSO	48.00000	47.60000	50.000	UGL	96.0	0.0	AANZ012
SV3701X1	E3-P37-S01	16-aug-1993	CSO	49.00000	48.60000	50.000	UGL	98.0	0.0	AANZ013
DD3901X1	E3-P39-D01	12-aug-1993	CSE	0.24000	0.04800	0.048	UGG	100.0	79.9	AAOA012
DX3901X1	E3-P39-D01	12-aug-1993	CSE	0.30000	0.05500	0.053	UGG	103.8	81.6	AAOA013
BX360301	E3-P36-B03	13-aug-1993	CSO	0.04100	0.03800	0.047	UGG	80.9	7.6	AAOA010
BX370302	E3-P37-B03	16-aug-1993	CSO	0.04500	0.03800	0.047	UGG	80.9	16.2	AAQK005
BD370302	E3-P37-B03	16-aug-1993	CSO	0.04500	0.03800	0.049	UGG	77.6	15.1	AAQK003
BX370301	E3-P37-B03	16-aug-1993	CSO	0.05100	0.04800	0.050	UGG	96.0	4.5	AAQK004
SX3601X1	E3-P36-S01	25-aug-1993	CSO	0.04400	0.04300	0.047	UGG	91.5	2.4	AARX004
SD3601X1	E3-P36-S01	25-aug-1993	CSO	0.05000	0.04800	0.048	UGG	100.0	3.2	AARX005
SX3602X1	E3-P36-S02	25-aug-1993	CSO	0.05300	0.05000	0.051	UGG	98.0	6.3	AARX006
SX3603X1	E3-P36-S03	25-aug-1993	CSO	0.05200	0.05000	0.048	UGG	104.2	2.9	AARX007

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

Table F-7 Surrogate Recoveries

SX3604X1	E3-P36-S04	25-aug-1993	CSO	0.05300	0.05000	0.048	UGG	104.2	5.2	AARX008
SX3605X1	E3-P36-S05	25-aug-1993	CSO	0.05000	0.04700	0.051	UGG	92.2	5.5	AARX009
SX3606X1	E3-P36-S06	25-aug-1993	CSO	0.04900	0.04500	0.049	UGG	91.8	7.0	AARX010
SX3607X1	E3-P36-S07	24-aug-1993	CSO	0.05700	0.04800	0.051	UGG	94.1	15.2	AARX003
SX3608X1	E3-P36-S08	25-aug-1993	CSO	0.05900	0.04900	0.050	UGG	98.0	16.6	AARX011
SX3609X1	E3-P36-S09	25-aug-1993	CSO	0.05900	0.04800	0.051	UGG	94.1	18.7	AARX012
SX3610X1	E3-P36-S10	25-aug-1993	CSO	0.05900	0.04800	0.050	UGG	96.0	18.4	AARX013
SX3611X1	E3-P36-S11	25-aug-1993	CSO	0.05200	0.04900	0.051	UGG	96.1	6.6	AARX014
SX3612X1	E3-P36-S12	25-aug-1993	CSO	0.05400	0.04900	0.049	UGG	100.0	9.2	AARY003
SX3701X1	E3-P37-S01	25-aug-1993	CSO	0.05200	0.04900	0.049	UGG	100.0	6.2	AARY004
SX3702X1	E3-P37-S02	25-aug-1993	CSO	0.05400	0.05000	0.050	UGG	100.0	7.6	AARY005
SX3703X1	E3-P37-S03	25-aug-1993	CSO	0.05100	0.04800	0.048	UGG	100.0	7.0	AARY006
SX3704X1	E3-P37-S04	25-aug-1993	CSO	0.05200	0.05000	0.050	UGG	100.0	4.9	AARY007
SX3705X1	E3-P37-S05	25-aug-1993	CSO	0.05100	0.05000	0.049	UGG	102.0	1.8	AARY008
SX3706X1	E3-P37-S06	25-aug-1993	CSO	0.05100	0.04900	0.049	UGG	100.0	3.1	AARY009
SX3801X1	E3-P38-S01	25-aug-1993	CSO	0.05400	0.05200	0.050	UGG	104.0	4.7	AARY010
SX3802X1	E3-P38-S02	25-aug-1993	CSO	0.04900	0.04800	0.047	UGG	102.1	2.6	AARY011
SX3803X1	E3-P38-S03	25-aug-1993	CSO	0.05200	0.05000	0.050	UGG	100.0	4.0	AARY012
SV3602X1	E3-P36-S07	24-aug-1993	CSO	51.00000	50.90000	50.000	UGL	102.0	0.0	AASA011
SV3601X1	E3-P36-S01	25-aug-1993	CSO	48.00000	48.10000	50.000	UGL	96.0	0.0	AASN004
SV3801X1	E3-P38-S01	25-aug-1993	CSO	50.00000	49.60000	50.000	UGL	100.0	0.0	AASN005
MXP31011	E3-P31-M01	01-sep-1993	CGW	47.00000	46.60000	50.000	UGL	94.0	0.0	AATL004
MXP36011	E3-P36-M01	01-sep-1993	CGW	47.00000	47.10000	50.000	UGL	94.0	0.0	AATL005
MXP36011	E3-P36-M01	01-sep-1993	CGW	47.00000	47.30000	50.000	UGL	94.0	0.0	AATL013
MXP36011	E3-P36-M01	01-sep-1993	CGW	48.00000	48.00000	50.000	UGL	96.0	0.0	AATL014
MXP37031	E3-P37-M03	01-sep-1993	CGW	47.00000	47.00000	50.000	UGL	94.0	0.0	AATL007
MRP37021	E3-P37-M02	02-sep-1993	CGW	50.00000	50.30000	50.000	UGL	100.0	0.0	AATV010
MVP36011	E3-P36-M01	01-sep-1993	CGW	49.00000	49.30000	50.000	UGL	98.0	0.0	AATV006
MXP36021	E3-P36-M02	02-sep-1993	CGW	47.00000	47.30000	50.000	UGL	94.0	0.0	AATV011
MDP36021	E3-P36-M02	02-sep-1993	CGW	50.00000	50.30000	50.000	UGL	100.0	0.0	AATV012
MXP36031	E3-P36-M03	02-sep-1993	CGW	47.00000	47.30000	50.000	UGL	94.0	0.0	AATV013
MXP37011	E3-P37-M01	02-sep-1993	CGW	46.00000	45.80000	50.000	UGL	92.0	0.0	AATV007
MDP37011	E3-P37-M01	02-sep-1993	CGW	48.00000	48.10000	50.000	UGL	96.0	0.0	AATV008
MXP37021	E3-P37-M02	02-sep-1993	CGW	47.00000	46.60000	50.000	UGL	94.0	0.0	AATV009
MVP37011	E3-P37-M01	02-sep-1993	CGW	47.00000	47.00000	50.000	UGL	94.0	0.0	AATX012
DXP37011	E3-P37-D01	16-sep-1993	CSE	0.23000	0.04800	0.053	UGG	90.6	79.7	AAYM008
DXP37021	E3-P37-D02	16-sep-1993	CSE	0.06600	0.04900	0.050	UGG	98.0	25.7	AAYM010
DXP37031	E3-P37-D03	16-sep-1993	CSE	0.32000	0.05000	0.051	UGG	98.0	84.5	AAYM009
WXP37011	E3-P37-D01	16-sep-1993	CSW	48.00000	47.80000	50.000	UGL	96.0	0.0	AAYW003
WXP37021	E3-P37-D02	16-sep-1993	CSW	51.00000	51.10000	50.000	UGL	102.0	0.0	AAYW007
WXP37031	E3-P37-D03	16-sep-1993	CSW	48.00000	47.90000	50.000	UGL	96.0	0.0	AAYW004
WVP37011	E3-P37-D01	16-sep-1993	CSW	46.00000	45.70000	50.000	UGL	92.0	0.0	AAYW008
DVP37011	E3-P37-D01	16-sep-1993	CSE	46.00000	46.10000	50.000	UGL	92.0	0.0	AAYW009
ERP31011	E3-P31-B01	24-sep-1993	CSO	50.00000	50.00000	50.000	UGL	100.0	0.0	ABBE010
EVP31021	E3-P31-B03	23-sep-1993	CSO	52.00000	52.30000	50.000	UGL	104.0	0.0	ABBE009
EXP31012	E3-P31-B01	24-sep-1993	CSO	0.04000	0.03800	0.048	UGG	79.2	5.2	ABBF004
EDP31012	E3-P31-B01	24-sep-1993	CSO	0.05100	0.04900	0.049	UGG	100.0	4.4	ABBF005
EXP31011	E3-P31-B01	24-sep-1993	CSO	0.05400	0.05100	0.049	UGG	104.1	6.4	ABBF003
EXP31022	E3-P31-B02	24-sep-1993	CSO	0.04700	0.04400	0.046	UGG	95.7	6.3	ABBF007
EXP31021	E3-P31-B02	24-sep-1993	CSO	0.05000	0.04600	0.049	UGG	93.9	7.2	ABBF006
EXP31031	E3-P31-B03	24-sep-1993	CSO	0.06400	0.04700	0.049	UGG	95.9	27.7	ABBF008

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

Table F-7 Surrogate Recoveries

EXP38012	E3-P38-B01	24-sep-1993	CSO	0.04900	0.04500	0.048	UGG	93.8	8.3	ABBF010
EXP38011	E3-P38-B01	24-sep-1993	CSO	0.05100	0.04800	0.049	UGG	98.0	5.9	ABBF009
EXP38021	E3-P38-B02	24-sep-1993	CSO	0.05000	0.04700	0.048	UGG	97.9	4.7	ABBF011
EXP38022	E3-P38-B02	24-sep-1993	CSO	0.05000	0.04800	0.049	UGG	98.0	4.4	ABBF012
MXP37032	E3-P37-M03	01-dec-1993	CGW	50.00000	50.10000	50.000	UGL	100.0	0.0	ABGY012
MXP37022	E3-P37-M02	01-dec-1993	CGW	52.00000	51.50000	50.000	UGL	104.0	0.0	ABGY011
MXP37012	E3-P37-M01	01-dec-1993	CGW	51.00000	51.20000	50.000	UGL	102.0	0.0	ABGY010
MXP36032	E3-P36-M03	01-dec-1993	CGW	50.00000	50.40000	50.000	UGL	100.0	0.0	ABGY009
MXP36022	E3-P36-M02	01-dec-1993	CGW	50.00000	49.60000	50.000	UGL	100.0	0.0	ABGY008
MXP36012	E3-P36-M01	01-dec-1993	CGW	53.00000	52.50000	50.000	UGL	106.0	0.0	ABGY007
MVP37012	E3-P37-M01	01-dec-1993	CGW	51.00000	50.80000	50.000	UGL	102.0	0.0	ABGZ009
MRP36012	E3-P36-M01	01-dec-1993	CGW	52.00000	51.60000	50.000	UGL	104.0	0.0	ABGZ008
MRP31012	E3-P31-M01	03-dec-1993	CGW	47.00000	47.30000	50.000	UGL	94.0	0.0	ABHA012
MDP31012	E3-P31-M01	03-dec-1993	CGW	48.00000	47.80000	50.000	UGL	96.0	0.0	ABHA011
MXP31012	E3-P31-M01	03-dec-1993	CGW	46.00000	46.20000	50.000	UGL	92.0	0.0	ABHA010

Analyte: 246TBP Method: SMV1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
BX360101	E3-P36-B01	05-aug-1993	CSO	0.97000	0.89500	1.670	UGG	53.6	7.3	AAMG005
BX360102	E3-P36-B01	05-aug-1993	CSO	1.10000	0.97900	1.670	UGG	58.6	8.6	AAMG006
BX360201	E3-P36-B02	05-aug-1993	CSO	0.67000	0.62500	1.670	UGG	37.4	6.8	AAMG007
BX360202	E3-P36-B02	05-aug-1993	CSO	0.78000	0.69300	1.670	UGG	41.5	10.7	AAMG008
BX370201	E3-P37-B02	06-aug-1993	CSO	0.64000	0.60500	1.670	UGG	36.2	4.9	AAMG009
BX370202	E3-P37-B02	06-aug-1993	CSO	0.89000	0.65800	1.670	UGG	39.4	25.7	AAMG010
BX370102	E3-P37-B01	09-aug-1993	CSO	1.20000	0.89400	1.670	UGG	53.5	23.3	AAMN003
BX370101	E3-P37-B01	09-aug-1993	CSO	1.20000	0.93600	1.670	UGG	56.1	22.3	AAMN004
BR3701X1	E3-P37-B02	09-aug-1993	CSO	78.00000	77.60000	100.000	UGL	78.0	0.0	AAND003
BR3801X1	E3-P38-B04	10-aug-1993	CSO	76.00000	75.80000	100.000	UGL	76.0	0.0	AAND005
BX380101	E3-P38-B04	10-aug-1993	CSO	0.89000	0.83500	1.670	UGG	50.0	6.2	AANO005
BX380102	E3-P38-B04	10-aug-1993	CSO	1.10000	0.84200	1.670	UGG	50.4	22.7	AANO006
DX3901X1	E3-P39-D01	11-aug-1993	CSE	3.00000	0.11000	1.700	UGG	32.4	81.6	AANP007
DD3901X1	E3-P39-D01	11-aug-1993	CSE	3.00000	0.11000	1.700	UGG	32.4	79.9	AANP008
DX3902X1	E3-P39-D02	11-aug-1993	CSE	4.00000	0.17000	1.700	UGG	50.0	76.2	AANP009
DX3903X1	E3-P39-D03	11-aug-1993	CSE	4.00000	0.17000	1.700	UGG	50.0	77.9	AANP010
DX3904X1	E3-P39-D04	11-aug-1993	CSE	3.00000	0.14000	1.700	UGG	41.2	77.5	AANP011
DX3906X1	E3-P39-D06	11-aug-1993	CSE	4.00000	0.16000	1.700	UGG	47.1	77.2	AANP013
BX360301	E3-P36-B03	13-aug-1993	CSO	0.86000	0.79500	1.670	UGG	47.6	7.6	AAOS010
BX360302	E3-P36-B03	13-aug-1993	CSO	0.87000	0.79800	1.670	UGG	47.8	8.7	AAOS011
BD370302	E3-P37-B03	16-aug-1993	CSO	1.10000	0.94600	1.670	UGG	56.7	15.1	AAOS012
BX370301	E3-P37-B03	16-aug-1993	CSO	0.88000	0.84000	1.670	UGG	50.3	4.5	AAOS013
BX370302	E3-P37-B03	16-aug-1993	CSO	0.74000	0.61600	1.670	UGG	36.9	16.2	AAOS014
SX3607X1	E3-P36-S07	24-aug-1993	CSO	0.96000	0.81600	1.670	UGG	48.9	15.2	AART011
SX3601X1	E3-P36-S01	25-aug-1993	CSO	0.60000	0.05900	1.700	UGG	34.7	2.4	AASH003
SD3601X1	E3-P36-S01	25-aug-1993	CSO	1.00000	0.11000	1.700	UGG	64.7	3.2	AASH004
SX3602X1	E3-P36-S02	25-aug-1993	CSO	0.66000	0.61800	1.670	UGG	37.0	6.3	AASH005
SX3603X1	E3-P36-S03	25-aug-1993	CSO	1.20000	1.15000	1.670	UGG	68.9	2.9	AASH006
SX3604X1	E3-P36-S04	25-aug-1993	CSO	0.60000	0.57300	1.670	UGG	34.3	5.2	AASH007
SX3605X1	E3-P36-S05	25-aug-1993	CSO	1.20000	1.18000	1.670	UGG	70.7	5.5	AASH008
SX3606X1	E3-P36-S06	25-aug-1993	CSO	1.20000	1.07000	1.670	UGG	64.1	7.0	AASH009
SX3608X1	E3-P36-S08	25-aug-1993	CSO	1.30000	1.09000	1.670	UGG	65.3	16.6	AASH010

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

SX3704X1	E3-P37-S04	25-aug-1993	CSO	1.30000	1.23000	1.670	UGG	73.7	4.9	AASI010
SX3703X1	E3-P37-S03	25-aug-1993	CSO	1.10000	0.99000	1.670	UGG	59.3	7.0	AASI009
SX3702X1	E3-P37-S02	25-aug-1993	CSO	1.40000	1.27000	1.670	UGG	76.1	7.6	AASI008
SX3701X1	E3-P37-S01	25-aug-1993	CSO	1.50000	1.37000	1.670	UGG	82.0	6.2	AASI007
SX3612X1	E3-P36-S12	25-aug-1993	CSO	0.20000	0.00800	1.700	UGG	11.8	9.2	AASI006
SX3611X1	E3-P36-S11	25-aug-1993	CSO	1.00000	0.22000	1.700	UGG	64.7	6.6	AASI005
SX3609X1	E3-P36-S09	25-aug-1993	CSO	1.40000	1.12000	1.670	UGG	67.1	18.7	AASI003
SX3705X1	E3-P37-S05	25-aug-1993	CSO	1.20000	1.18000	1.670	UGG	70.7	1.8	AASP003
SX3706X1	E3-P37-S06	25-aug-1993	CSO	1.30000	1.23000	1.670	UGG	73.7	3.1	AASP004
SX3801X1	E3-P38-S01	25-aug-1993	CSO	1.30000	1.25000	1.670	UGG	74.9	4.7	AASP005
SX3802X1	E3-P38-S02	25-aug-1993	CSO	1.30000	1.30000	1.670	UGG	77.8	2.6	AASP006
SX3803X1	E3-P38-S03	25-aug-1993	CSO	1.50000	1.41000	1.670	UGG	84.4	4.0	AASP007
MXP31011	E3-P31-M01	01-sep-1993	CGW	52.00000	51.50000	100.000	UGL	52.0	0.0	AATS009
MXP36011	E3-P36-M01	01-sep-1993	CGW	83.00000	82.60000	100.000	UGL	83.0	0.0	AATS010
MXP37031	E3-P37-M03	01-sep-1993	CGW	97.00000	97.30000	100.000	UGL	97.0	0.0	AATS012
MRP37021	E3-P37-M02	02-sep-1993	CGW	92.00000	91.50000	115.000	UGL	80.0	0.0	AAUF005
MDP36021	E3-P36-M02	02-sep-1993	CGW	73.00000	72.70000	100.000	UGL	73.0	0.0	AAUF007
MXP36021	E3-P36-M02	02-sep-1993	CGW	80.00000	79.90000	112.000	UGL	71.4	0.0	AAUF006
MXP36031	E3-P36-M03	02-sep-1993	CGW	100.00000	102.00000	133.000	UGL	75.2	0.0	AAUF008
MDP37011	E3-P37-M01	02-sep-1993	CGW	60.00000	59.50000	100.000	UGL	60.0	0.0	AAUF003
MXP37021	E3-P37-M02	02-sep-1993	CGW	71.00000	70.80000	100.000	UGL	71.0	0.0	AAUF004
SX3610X1	E3-P36-S10	03-sep-1993	CSO	1.10000	1.07000	1.670	UGG	64.1	6.4	AAUV003
MXP37011	E3-P37-M01	02-sep-1993	CGW	50.00000	50.40000	100.000	UGL	50.0	0.0	AAUW003
WXP37011	E3-P37-D01	16-sep-1993	CSW	86.00000	86.00000	100.000	UGL	86.0	0.0	AAYQ008
WXP37021	E3-P37-D02	16-sep-1993	CSW	49.00000	48.80000	112.000	UGL	43.8	0.0	AAYQ012
WXP37031	E3-P37-D03	16-sep-1993	CSW	28.00000	27.80000	100.000	UGL	28.0	0.0	AAYQ009
DXP37011	E3-P37-D01	16-sep-1993	CSE	4.20000	0.85300	1.670	UGG	51.1	79.7	AAYZ003
DXP37021	E3-P37-D02	16-sep-1993	CSE	1.40000	1.01000	1.670	UGG	60.5	25.7	AAYZ005
DXP37031	E3-P37-D03	16-sep-1993	CSE	6.50000	1.00000	1.670	UGG	59.9	84.5	AAYZ004
ERP31011	E3-P31-B01	24-sep-1993	CSO	63.00000	63.00000	100.000	UGL	63.0	0.0	ABAK011
BXP37041	E3-P37-B04	01-dec-1993	CSO	1.30000	1.19000	1.670	UGG	71.3	11.2	ABFT003
BXP37042	E3-P37-B04	01-dec-1993	CSO	0.99000	0.85800	1.670	UGG	51.4	13.3	ABFT004
BXP38031	E3-P38-B03	01-dec-1993	CSO	0.95000	0.85200	1.670	UGG	51.0	10.0	ABFT005
BXP38032	E3-P38-B03	01-dec-1993	CSO	1.40000	1.08000	1.670	UGG	64.7	21.2	ABFT006
MXP36012	E3-P36-M01	01-dec-1993	CGW	80.00000	79.50000	100.000	UGL	80.0	0.0	ABFV004
MXP36022	E3-P36-M02	01-dec-1993	CGW	85.00000	84.70000	100.000	UGL	85.0	0.0	ABFV005
MXP36032	E3-P36-M03	01-dec-1993	CGW	75.00000	75.10000	100.000	UGL	75.0	0.0	ABFV006
MXP37012	E3-P37-M01	01-dec-1993	CGW	82.00000	82.20000	100.000	UGL	82.0	0.0	ABFV007
MXP37022	E3-P37-M02	01-dec-1993	CGW	68.00000	67.50000	100.000	UGL	68.0	0.0	ABFV008
MXP37032	E3-P37-M03	01-dec-1993	CGW	42.00000	41.60000	100.000	UGL	42.0	0.0	ABFV009
SXP36122	E3-P36-S12	02-dec-1993	CSO	0.80000	0.15000	1.700	UGG	44.1	8.0	ABGL005
MRP36012	E3-P36-M01	01-dec-1993	CGW	58.00000	57.90000	100.000	UGL	58.0	0.0	ABGM004
MRP31012	E3-P31-M01	03-dec-1993	CGW	41.00000	41.40000	100.000	UGL	41.0	0.0	ABHC006
MDP31012	E3-P31-M01	03-dec-1993	CGW	55.00000	55.40000	100.000	UGL	55.0	0.0	ABHC005
MXP31012	E3-P31-M01	03-dec-1993	CGW	61.00000	61.10000	119.000	UGL	51.3	0.0	ABHC004

Analyte: 246TBP Method: SMV1 Lab: UB

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
EXP31011	E3-P31-B01	24-sep-1993	CSO	2.60000	2.40000	3.300	UGG	72.7	9.0	AEYZ003
EXP31012	E3-P31-B01	24-sep-1993	CSO	2.10000	2.00000	3.300	UGG	60.6	4.7	AEYZ004

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

EDP31012	E3-P31-B01	24-sep-1993	CSO	3.20000	3.00000	3.300	UGG	90.9	6.3	AEYZ005
EXP31021	E3-P31-B02	24-sep-1993	CSO	3.50000	3.20000	3.300	UGG	97.0	8.8	AEYZ006
EXP31022	E3-P31-B02	24-sep-1993	CSO	2.80000	2.60000	3.300	UGG	78.8	7.5	AEYZ007
EXP31031	E3-P31-B03	24-sep-1993	CSO	4.50000	3.20000	3.300	UGG	97.0	29.4	AEYZ008
EXP38011	E3-P38-B01	24-sep-1993	CSO	3.20000	3.00000	3.300	UGG	90.9	5.5	AEYZ009
EXP38012	E3-P38-B01	24-sep-1993	CSO	2.50000	2.20000	3.300	UGG	66.7	10.4	AEYZ010
EXP38021	E3-P38-B02	24-sep-1993	CSO	2.00000	1.90000	3.300	UGG	57.6	4.6	AEYZ011
EXP38022	E3-P38-B02	24-sep-1993	CSO	3.20000	3.00000	3.300	UGG	90.9	5.2	AEYZ012

Analyte: 2A46DT Method: EXL2 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
MXP31011	E3-P31-M01	01-sep-1993	CGW	52.10000	52.10000	80.000	UGL	65.1	0.0	AAUI005
EXP31011	E3-P31-B01	24-sep-1993	CSO	85.30000	79.80000	80.000	UGG	99.8	6.4	ABAU006
EXP31012	E3-P31-B01	24-sep-1993	CSO	76.30000	72.30000	80.000	UGG	90.4	5.2	ABAU007
EDP31012	E3-P31-B01	24-sep-1993	CSO	71.00000	67.90000	80.000	UGG	84.9	4.4	ABAU008
EDP31012	E3-P31-B02	24-sep-1993	CSO	68.60000	63.70000	80.000	UGG	79.6	7.2	ABAU009
EXP31021	E3-P31-B02	24-sep-1993	CSO	84.70000	79.40000	80.000	UGG	99.3	6.3	ABAU010
EXP31022	E3-P31-B02	24-sep-1993	CSO	94.20000	68.10000	80.000	UGG	85.1	27.7	ABAU011
EXP31031	E3-P31-B03	24-sep-1993	CSO	69.20000	69.20000	80.000	UGL	86.5	0.0	ABBA007
ERP31011	E3-P31-B01	24-sep-1993	CSO	73.70000	73.70000	80.000	UGL	92.1	0.0	ABBA006
WXP37031	E3-P37-D03	23-sep-1993	CSW	193.00000	66.50000	80.000	UGG	83.1	65.5	ABBD005
DXP37031	E3-P37-D03	23-sep-1993	CSE	56.00000	56.00000	80.000	UGL	70.0	0.0	ABGP008
MRP31012	E3-P31-M01	03-dec-1993	CGW	65.80000	65.80000	80.000	UGL	82.3	0.0	ABGP007
MDP31012	E3-P31-M01	03-dec-1993	CGW	76.10000	76.10000	80.000	UGL	95.1	0.0	ABGP006
MXP31012	E3-P31-M01	03-dec-1993	CGW							

Analyte: 2FBP Method: SMV1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
BX360101	E3-P36-B01	05-aug-1993	CSO	0.33000	0.30300	1.670	UGG	18.1	7.3	AAMG005
BX360102	E3-P36-B01	05-aug-1993	CSO	0.09200	0.08400	1.670	UGG	5.0	8.6	AAMG006
BX360201	E3-P36-B02	05-aug-1993	CSO	0.06000	0.05600	1.670	UGG	3.4	6.8	AAMG007
BX360202	E3-P36-B02	05-aug-1993	CSO	0.04600	0.04100	1.670	UGG	2.5	10.7	AAMG008
BX370201	E3-P37-B02	06-aug-1993	CSO	0.02200	0.02100	1.670	UGG	1.3	4.9	AAMG009
BX370202	E3-P37-B02	06-aug-1993	CSO	0.07400	0.05500	1.670	UGG	3.3	25.7	AAMG010
BX370102	E3-P37-B01	09-aug-1993	CSO	1.80000	1.37000	1.670	UGG	82.0	23.3	AAMN003
BX370101	E3-P37-B01	09-aug-1993	CSO	1.80000	1.36000	1.670	UGG	81.4	22.3	AAMN004
BR3701X1	E3-P37-B02	09-aug-1993	CSO	91.00000	90.90000	100.000	UGL	91.0	0.0	AAND003
BR3801X1	E3-P38-B04	10-aug-1993	CSO	87.00000	87.20000	100.000	UGL	87.0	0.0	AAND005
BX380101	E3-P38-B04	10-aug-1993	CSO	0.42000	0.39800	1.670	UGG	23.8	6.2	AANO005
BX380102	E3-P38-B04	10-aug-1993	CSO	0.08600	0.06700	1.670	UGG	4.0	22.7	AANO006
DX3901X1	E3-P39-D01	11-aug-1993	CSE	4.00000	0.15000	1.700	UGG	44.1	81.6	AANP007
DD3901X1	E3-P39-D01	11-aug-1993	CSE	3.00000	0.11000	1.700	UGG	32.4	79.9	AANP008
DX3902X1	E3-P39-D02	11-aug-1993	CSE	3.00000	0.16000	1.700	UGG	47.1	76.2	AANP009
DX3903X1	E3-P39-D03	11-aug-1993	CSE	5.00000	0.21000	1.700	UGG	61.8	77.9	AANP010
DX3904X1	E3-P39-D04	11-aug-1993	CSE	4.00000	0.16000	1.700	UGG	47.1	77.5	AANP011
DX3906X1	E3-P39-D06	11-aug-1993	CSE	4.00000	0.17000	1.700	UGG	50.0	77.2	AANP013
BX360301	E3-P36-B03	13-aug-1993	CSO	0.27000	0.25400	1.670	UGG	15.2	7.6	AAOS010
BX360302	E3-P36-B03	13-aug-1993	CSO	0.14000	0.12400	1.670	UGG	7.4	8.7	AAOS011
BD370302	E3-P37-B03	16-aug-1993	CSO	0.02600	0.02200	1.670	UGG	1.3	15.1	AAOS012
BX370301	E3-P37-B03	16-aug-1993	CSO	0.23000	0.21800	1.670	UGG	13.1	4.5	AAOS013

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

BX370302	E3-P37-B03	16-aug-1993	CSO	0.05800	0.04800	1.670	UGG	2.9	16.2	AAOS014
SX3607X1	E3-P36-S07	24-aug-1993	CSO	0.77000	0.65700	1.670	UGG	39.3	15.2	AART011
SX3601X1	E3-P36-S01	25-aug-1993	CSO	1.00000	0.09600	1.700	UGG	56.5	2.4	AASH003
SD3601X1	E3-P36-S01	25-aug-1993	CSO	1.00000	0.14000	1.700	UGG	82.4	3.2	AASH004
SX3602X1	E3-P36-S02	25-aug-1993	CSO	0.54000	0.50600	1.670	UGG	30.3	6.3	AASH005
SX3603X1	E3-P36-S03	25-aug-1993	CSO	0.70000	0.68200	1.670	UGG	40.8	2.9	AASH006
SX3604X1	E3-P36-S04	25-aug-1993	CSO	0.36000	0.33700	1.670	UGG	20.2	5.2	AASH007
SX3605X1	E3-P36-S05	25-aug-1993	CSO	0.78000	0.73300	1.670	UGG	43.9	5.5	AASH008
SX3606X1	E3-P36-S06	25-aug-1993	CSO	0.51000	0.47200	1.670	UGG	28.3	7.0	AASH009
SX3608X1	E3-P36-S08	25-aug-1993	CSO	1.10000	0.89800	1.670	UGG	53.8	16.6	AASH010
SX3704X1	E3-P37-S04	25-aug-1993	CSO	1.40000	1.37000	1.670	UGG	82.0	4.9	AASI010
SX3703X1	E3-P37-S03	25-aug-1993	CSO	1.10000	0.98200	1.670	UGG	58.8	7.0	AASI009
SX3702X1	E3-P37-S02	25-aug-1993	CSO	1.50000	1.42000	1.670	UGG	85.0	7.6	AASI008
SX3701X1	E3-P37-S01	25-aug-1993	CSO	1.50000	1.43000	1.670	UGG	85.6	6.2	AASI007
SX3612X1	E3-P36-S12	25-aug-1993	CSO	2.00000	0.05700	1.700	UGG	83.8	9.2	AASI006
SX3611X1	E3-P36-S11	25-aug-1993	CSO	2.00000	0.30000	1.700	UGG	88.2	6.6	AASI005
SX3609X1	E3-P36-S09	25-aug-1993	CSO	1.70000	1.37000	1.670	UGG	82.0	18.7	AASI003
SX3705X1	E3-P37-S05	25-aug-1993	CSO	0.97000	0.94800	1.670	UGG	56.8	1.8	AASP003
SX3706X1	E3-P37-S06	25-aug-1993	CSO	0.88000	0.85200	1.670	UGG	51.0	3.1	AASP004
SX3801X1	E3-P38-S01	25-aug-1993	CSO	1.10000	1.09000	1.670	UGG	65.3	4.7	AASP005
SX3802X1	E3-P38-S02	25-aug-1993	CSO	1.20000	1.13000	1.670	UGG	67.7	2.6	AASP006
SX3803X1	E3-P38-S03	25-aug-1993	CSO	1.40000	1.34000	1.670	UGG	80.2	4.0	AASP007
MXP31011	E3-P31-M01	01-sep-1993	CGW	82.00000	82.10000	100.000	UGL	82.0	0.0	AATS009
MXP36011	E3-P36-M01	01-sep-1993	CGW	83.00000	83.10000	100.000	UGL	83.0	0.0	AATS010
MXP37031	E3-P37-M03	01-sep-1993	CGW	86.00000	85.60000	100.000	UGL	86.0	0.0	AATS012
MRP37021	E3-P37-M02	02-sep-1993	CGW	79.00000	78.70000	115.000	UGL	68.7	0.0	AAUF005
MDP36021	E3-P36-M02	02-sep-1993	CGW	76.00000	75.50000	100.000	UGL	76.0	0.0	AAUF007
MXP36021	E3-P36-M02	02-sep-1993	CGW	86.00000	85.90000	112.000	UGL	76.8	0.0	AAUF006
MXP36031	E3-P36-M03	02-sep-1993	CGW	99.00000	98.50000	133.000	UGL	74.4	0.0	AAUF008
MDP37011	E3-P37-M01	02-sep-1993	CGW	73.00000	73.00000	100.000	UGL	73.0	0.0	AAUF003
MXP37021	E3-P37-M02	02-sep-1993	CGW	75.00000	75.10000	100.000	UGL	75.0	0.0	AAUF004
SX3610X1	E3-P36-S10	03-sep-1993	CSO	0.98000	0.92000	1.670	UGG	55.1	6.4	AAUV003
MXP37011	E3-P37-M01	02-sep-1993	CGW	90.00000	90.00000	100.000	UGL	90.0	0.0	AAUW003
WXP37011	E3-P37-D01	16-sep-1993	CSW	58.00000	58.20000	100.000	UGL	58.0	0.0	AAYQ008
WXP37021	E3-P37-D02	16-sep-1993	CSW	59.00000	58.90000	112.000	UGL	52.7	0.0	AAYQ012
WXP37031	E3-P37-D03	16-sep-1993	CSW	72.00000	71.70000	100.000	UGL	72.0	0.0	AAYQ009
DXP37011	E3-P37-D01	16-sep-1993	CSE	3.20000	0.64000	1.670	UGG	38.3	79.7	AAYZ003
DXP37021	E3-P37-D02	16-sep-1993	CSE	0.91000	0.67500	1.670	UGG	40.4	25.7	AAYZ005
DXP37031	E3-P37-D03	16-sep-1993	CSE	5.90000	0.90700	1.670	UGG	54.3	84.5	AAYZ004
ERP31011	E3-P31-B01	24-sep-1993	CSO	73.00000	73.20000	100.000	UGL	73.0	0.0	ABAK011
BXP37041	E3-P37-B04	01-dec-1993	CSO	1.30000	1.13000	1.670	UGG	67.7	11.2	ABFT003
BXP37042	E3-P37-B04	01-dec-1993	CSO	1.30000	1.12000	1.670	UGG	67.1	13.3	ABFT004
BXP38031	E3-P38-B03	01-dec-1993	CSO	1.20000	1.08000	1.670	UGG	64.7	10.0	ABFT005
BXP38032	E3-P38-B03	01-dec-1993	CSO	1.40000	1.08000	1.670	UGG	64.7	21.2	ABFT006
MXP36012	E3-P36-M01	01-dec-1993	CGW	95.00000	94.60000	100.000	UGL	95.0	0.0	ABFV004
MXP36022	E3-P36-M02	01-dec-1993	CGW	96.00000	95.50000	100.000	UGL	96.0	0.0	ABFV005
MXP36032	E3-P36-M03	01-dec-1993	CGW	100.00000	104.00000	100.000	UGL	100.0	0.0	ABFV006
MXP37012	E3-P37-M01	01-dec-1993	CGW	72.00000	71.90000	100.000	UGL	72.0	0.0	ABFV007
MXP37022	E3-P37-M02	01-dec-1993	CGW	94.00000	93.90000	100.000	UGL	94.0	0.0	ABFV008
MXP37032	E3-P37-M03	01-dec-1993	CGW	95.00000	94.60000	100.000	UGL	95.0	0.0	ABFV009
SXP36122	E3-P36-S12	02-dec-1993	CSO	1.00000	0.27000	1.700	UGG	79.4	8.0	ABGL005

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

MRP36012	E3-P36-M01	01-dec-1993	CGW	75.00000	74.70000	100.000	UGL	75.0	0.0	ABGM004
MRP31012	E3-P31-M01	03-dec-1993	CGW	69.00000	68.60000	100.000	UGL	69.0	0.0	ABHC006
MDP31012	E3-P31-M01	03-dec-1993	CGW	76.00000	76.20000	100.000	UGL	76.0	0.0	ABHC005
MXP31012	E3-P31-M01	03-dec-1993	CGW	100.00000	101.00000	119.000	UGL	84.0	0.0	ABHC004

Analyte: 2FBP Method: SMV1 Lab: UB

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
EXP31011	E3-P31-B01	24-sep-1993	CSO	3.30000	3.00000	3.300	UGG	90.9	9.0	AEYZ003
EXP31012	E3-P31-B01	24-sep-1993	CSO	2.60000	2.50000	3.300	UGG	75.8	4.7	AEYZ004
EDP31012	E3-P31-B01	24-sep-1993	CSO	3.30000	3.10000	3.300	UGG	93.9	6.3	AEYZ005
EXP31021	E3-P31-B02	24-sep-1993	CSO	3.50000	3.20000	3.300	UGG	97.0	8.8	AEYZ006
EXP31022	E3-P31-B02	24-sep-1993	CSO	3.20000	3.00000	3.300	UGG	90.9	7.5	AEYZ007
EXP31031	E3-P31-B03	24-sep-1993	CSO	4.40000	3.10000	3.300	UGG	93.9	29.4	AEYZ008
EXP38011	E3-P38-B01	24-sep-1993	CSO	3.40000	3.20000	3.300	UGG	97.0	5.5	AEYZ009
EXP38012	E3-P38-B01	24-sep-1993	CSO	3.20000	2.90000	3.300	UGG	87.9	10.4	AEYZ010
EXP38021	E3-P38-B02	24-sep-1993	CSO	3.00000	2.90000	3.300	UGG	87.9	4.6	AEYZ011
EXP38022	E3-P38-B02	24-sep-1993	CSO	3.10000	2.90000	3.300	UGG	87.9	5.2	AEYZ012

Analyte: 2FP Method: SMV1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
BX360101	E3-P36-B01	05-aug-1993	CSO	0.94000	0.87200	1.670	UGG	52.2	7.3	AAMG005
BX360102	E3-P36-B01	05-aug-1993	CSO	0.76000	0.69400	1.670	UGG	41.6	8.6	AAMG006
BX360201	E3-P36-B02	05-aug-1993	CSO	0.42000	0.38900	1.670	UGG	23.3	6.8	AAMG007
BX360202	E3-P36-B02	05-aug-1993	CSO	0.54000	0.47900	1.670	UGG	28.7	10.7	AAMG008
BX370201	E3-P37-B02	06-aug-1993	CSO	0.37000	0.35100	1.670	UGG	21.0	4.9	AAMG009
BX370202	E3-P37-B02	06-aug-1993	CSO	0.40000	0.29800	1.670	UGG	17.8	25.7	AAMG010
BX370102	E3-P37-B01	09-aug-1993	CSO	1.70000	1.29000	1.670	UGG	77.3	23.3	AAMN003
BX370101	E3-P37-B01	09-aug-1993	CSO	1.50000	1.19000	1.670	UGG	71.3	22.3	AAMN004
BR3701X1	E3-P37-B02	09-aug-1993	CSO	51.00000	51.00000	100.000	UGL	51.0	0.0	AAND003
BR3801X1	E3-P38-B04	10-aug-1993	CSO	41.00000	41.30000	100.000	UGL	41.0	0.0	AAND005
BX380101	E3-P38-B04	10-aug-1993	CSO	0.28000	0.26600	1.670	UGG	15.9	6.2	AANO005
BX380102	E3-P38-B04	10-aug-1993	CSO	0.43000	0.33300	1.670	UGG	19.9	22.7	AANO006
DX3901X1	E3-P39-D01	11-aug-1993	CSE	1.00000	0.03600	1.700	UGG	10.6	81.6	AANP007
DD3901X1	E3-P39-D01	11-aug-1993	CSE	0.90000	0.03600	1.700	UGG	10.6	79.9	AANP008
DX3902X1	E3-P39-D02	11-aug-1993	CSE	1.00000	0.06600	1.700	UGG	19.4	76.2	AANP009
DX3903X1	E3-P39-D03	11-aug-1993	CSE	2.00000	0.08200	1.700	UGG	24.1	77.9	AANP010
DX3904X1	E3-P39-D04	11-aug-1993	CSE	2.00000	0.08600	1.700	UGG	25.3	77.5	AANP011
DX3906X1	E3-P39-D06	11-aug-1993	CSE	2.00000	0.09000	1.700	UGG	26.5	77.2	AANP013
BX360301	E3-P36-B03	13-aug-1993	CSO	0.56000	0.52000	1.670	UGG	31.1	7.6	AAOS010
BX360302	E3-P36-B03	13-aug-1993	CSO	0.60000	0.54800	1.670	UGG	32.8	8.7	AAOS011
BD370302	E3-P37-B03	16-aug-1993	CSO	0.57000	0.48300	1.670	UGG	28.9	15.1	AAOS012
BX370301	E3-P37-B03	16-aug-1993	CSO	0.61000	0.58000	1.670	UGG	34.7	4.5	AAOS013
BX370302	E3-P37-B03	16-aug-1993	CSO	0.76000	0.64000	1.670	UGG	38.3	16.2	AAOS014
SX3607X1	E3-P36-S07	24-aug-1993	CSO	0.63000	0.53700	1.670	UGG	32.2	15.2	AART011
SX3601X1	E3-P36-S01	25-aug-1993	CSO	LT 3.00000	0.33000	1.700	UGG	0.0	2.4	AASH003
SD3601X1	E3-P36-S01	25-aug-1993	CSO	LT 3.00000	0.33000	1.700	UGG	0.0	3.2	AASH004
SX3602X1	E3-P36-S02	25-aug-1993	CSO	0.24000	0.22200	1.670	UGG	13.3	6.3	AASH005
SX3603X1	E3-P36-S03	25-aug-1993	CSO	0.39000	0.38200	1.670	UGG	22.9	2.9	AASH006
SX3604X1	E3-P36-S04	25-aug-1993	CSO	0.07100	0.06800	1.670	UGG	4.1	5.2	AASH007

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

SX3605X1	E3-P36-S05	25-aug-1993	CSO		0.40000	0.37500	1.670	UGG	22.5	5.5	AASH008
SX3606X1	E3-P36-S06	25-aug-1993	CSO		0.18000	0.16700	1.670	UGG	10.0	7.0	AASH009
SX3608X1	E3-P36-S08	25-aug-1993	CSO		0.59000	0.49600	1.670	UGG	29.7	16.6	AASH010
SX3704X1	E3-P37-S04	25-aug-1993	CSO		1.20000	1.14000	1.670	UGG	68.3	4.9	AASI010
SX3703X1	E3-P37-S03	25-aug-1993	CSO		0.93000	0.86800	1.670	UGG	52.0	7.0	AASI009
SX3702X1	E3-P37-S02	25-aug-1993	CSO		1.50000	1.35000	1.670	UGG	80.8	7.6	AASI008
SX3701X1	E3-P37-S01	25-aug-1993	CSO		1.40000	1.28000	1.670	UGG	76.7	6.2	AASI007
SX3612X1	E3-P36-S12	25-aug-1993	CSO	LT	8.00000	0.33000	1.700	UGG	0.0	9.2	AASI006
SX3611X1	E3-P36-S11	25-aug-1993	CSO		0.80000	0.15000	1.700	UGG	44.1	6.6	AASI005
SX3609X1	E3-P36-S09	25-aug-1993	CSO		1.50000	1.20000	1.670	UGG	71.9	18.7	AASI003
SX3705X1	E3-P37-S05	25-aug-1993	CSO		0.78000	0.76500	1.670	UGG	45.8	1.8	AASP003
SX3706X1	E3-P37-S06	25-aug-1993	CSO		0.56000	0.54300	1.670	UGG	32.5	3.1	AASP004
SX3801X1	E3-P38-S01	25-aug-1993	CSO		0.70000	0.66600	1.670	UGG	39.9	4.7	AASP005
SX3802X1	E3-P38-S02	25-aug-1993	CSO		0.83000	0.81200	1.670	UGG	48.6	2.6	AASP006
SX3803X1	E3-P38-S03	25-aug-1993	CSO		1.10000	1.03000	1.670	UGG	61.7	4.0	AASP007
MXP31011	E3-P31-M01	01-sep-1993	CGW		31.00000	30.60000	100.000	UGL	31.0	0.0	AATS009
MXP36011	E3-P36-M01	01-sep-1993	CGW		47.00000	47.20000	100.000	UGL	47.0	0.0	AATS010
MXP37031	E3-P37-M03	01-sep-1993	CGW		36.00000	36.30000	100.000	UGL	36.0	0.0	AATS012
MRP37021	E3-P37-M02	02-sep-1993	CGW		58.00000	57.70000	115.000	UGL	50.4	0.0	AAUF005
MDP36021	E3-P36-M02	02-sep-1993	CGW		48.00000	48.00000	100.000	UGL	48.0	0.0	AAUF007
MXP36021	E3-P36-M02	02-sep-1993	CGW		54.00000	54.30000	112.000	UGL	48.2	0.0	AAUF006
MXP36031	E3-P36-M03	02-sep-1993	CGW		73.00000	72.50000	133.000	UGL	54.9	0.0	AAUF008
MDP37011	E3-P37-M01	02-sep-1993	CGW		30.00000	30.00000	100.000	UGL	30.0	0.0	AAUF003
MXP37021	E3-P37-M02	02-sep-1993	CGW		49.00000	49.30000	100.000	UGL	49.0	0.0	AAUF004
SX3610X1	E3-P36-S10	03-sep-1993	CSO		0.93000	0.87200	1.670	UGG	52.2	6.4	AAUV003
MXP37011	E3-P37-M01	02-sep-1993	CGW		24.00000	23.50000	100.000	UGL	24.0	0.0	AAUW003
WXP37011	E3-P37-D01	16-sep-1993	CSW		46.00000	46.30000	100.000	UGL	46.0	0.0	AAYQ008
WXP37021	E3-P37-D02	16-sep-1993	CSW		38.00000	38.40000	112.000	UGL	33.9	0.0	AAYQ012
WXP37031	E3-P37-D03	16-sep-1993	CSW		28.00000	28.40000	100.000	UGL	28.0	0.0	AAYQ009
DXP37011	E3-P37-D01	16-sep-1993	CSE		3.80000	0.76400	1.670	UGG	45.8	79.7	AAYZ003
DXP37021	E3-P37-D02	16-sep-1993	CSE		0.93000	0.68800	1.670	UGG	41.2	25.7	AAYZ005
DXP37031	E3-P37-D03	16-sep-1993	CSE		6.20000	0.95400	1.670	UGG	57.1	84.5	AAYZ004
ERP31011	E3-P31-B01	24-sep-1993	CSO		43.00000	42.50000	100.000	UGL	43.0	0.0	ABAK011
BXP37041	E3-P37-B04	01-dec-1993	CSO		1.40000	1.28000	1.670	UGG	76.7	11.2	ABFT003
BXP37042	E3-P37-B04	01-dec-1993	CSO		1.40000	1.20000	1.670	UGG	71.9	13.3	ABFT004
BXP38031	E3-P38-B03	01-dec-1993	CSO		1.30000	1.17000	1.670	UGG	70.1	10.0	ABFT005
BXP38032	E3-P38-B03	01-dec-1993	CSO		1.50000	1.19000	1.670	UGG	71.3	21.2	ABFT006
MXP36012	E3-P36-M01	01-dec-1993	CGW		50.00000	49.70000	100.000	UGL	50.0	0.0	ABFV004
MXP36022	E3-P36-M02	01-dec-1993	CGW		48.00000	47.80000	100.000	UGL	48.0	0.0	ABFV005
MXP36032	E3-P36-M03	01-dec-1993	CGW		45.00000	44.70000	100.000	UGL	45.0	0.0	ABFV006
MXP37012	E3-P37-M01	01-dec-1993	CGW		54.00000	54.00000	100.000	UGL	54.0	0.0	ABFV007
MXP37022	E3-P37-M02	01-dec-1993	CGW		46.00000	46.00000	100.000	UGL	46.0	0.0	ABFV008
MXP37032	E3-P37-M03	01-dec-1993	CGW		27.00000	26.90000	100.000	UGL	27.0	0.0	ABFV009
SXP36122	E3-P36-S12	02-dec-1993	CSO		0.90000	0.16000	1.700	UGG	47.1	8.0	ABGL005
MRP36012	E3-P36-M01	01-dec-1993	CGW		40.00000	39.90000	100.000	UGL	40.0	0.0	ABGM004
MRP31012	E3-P31-M01	03-dec-1993	CGW		28.00000	28.10000	100.000	UGL	28.0	0.0	ABHC006
MDP31012	E3-P31-M01	03-dec-1993	CGW		37.00000	37.00000	100.000	UGL	37.0	0.0	ABHC005
MXP31012	E3-P31-M01	03-dec-1993	CGW		43.00000	43.30000	119.000	UGL	36.1	0.0	ABHC004

Analyte: 2FP Method: SMV1 Lab: UB

Field	Site ID	Sample	Media	Corrected	Uncorrected	Spike	Units	%	%	Lot/

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

Table F-7 Surrogate Recoveries

Sample no		Date	Type	Value	Value	Amount		Rec.	H20	Sample
EXP31011	E3-P31-B01	24-sep-1993	CSO	3.20000	2.90000	3.300	UGG	87.9	9.0	AEYZ003
EXP31012	E3-P31-B01	24-sep-1993	CSO	2.50000	2.40000	3.300	UGG	72.7	4.7	AEYZ004
EDP31012	E3-P31-B01	24-sep-1993	CSO	3.30000	3.10000	3.300	UGG	93.9	6.3	AEYZ005
EXP31021	E3-P31-B02	24-sep-1993	CSO	3.50000	3.20000	3.300	UGG	97.0	8.8	AEYZ006
EXP31022	E3-P31-B02	24-sep-1993	CSO	3.00000	2.80000	3.300	UGG	84.9	7.5	AEYZ007
EXP31031	E3-P31-B03	24-sep-1993	CSO	4.40000	3.10000	3.300	UGG	93.9	29.4	AEYZ008
EXP38011	E3-P38-B01	24-sep-1993	CSO	3.20000	3.00000	3.300	UGG	90.9	5.5	AEYZ009
EXP38012	E3-P38-B01	24-sep-1993	CSO	2.90000	2.60000	3.300	UGG	78.8	10.4	AEYZ010
EXP38021	E3-P38-B02	24-sep-1993	CSO	2.60000	2.50000	3.300	UGG	75.8	4.6	AEYZ011
EXP38022	E3-P38-B02	24-sep-1993	CSO	3.10000	2.90000	3.300	UGG	87.9	5.2	AEYZ012

Analyte: 34DNT Method: EXL1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
MXP31011	E3-P31-M01	01-sep-1993	CGW	6.64000	6.64000	8.000	UGL	83.0	0.0	AAUH005
EXP31011	E3-P31-B01	24-sep-1993	CSO	8.40000	7.86000	8.000	UGG	98.3	6.4	ABAT008
EXP31012	E3-P31-B01	24-sep-1993	CSO	8.12000	7.70000	8.000	UGG	96.3	5.2	ABAT009
EDP31012	E3-P31-B01	24-sep-1993	CSO	8.19000	7.83000	8.000	UGG	97.9	4.4	ABAT010
EXP31021	E3-P31-B02	24-sep-1993	CSO	8.25000	7.66000	8.000	UGG	95.8	7.2	ABAT011
EXP31022	E3-P31-B02	24-sep-1993	CSO	8.32000	7.80000	8.000	UGG	97.5	6.3	ABAT012
EXP31031	E3-P31-B03	24-sep-1993	CSO	10.90000	7.85000	8.000	UGG	98.1	27.7	ABAT013
ERP31011	E3-P31-B01	24-sep-1993	CSO	6.70000	6.70000	8.000	UGL	83.8	0.0	ABAZ007
WXP37031	E3-P37-D03	23-sep-1993	CSW	6.61000	6.61000	8.000	UGL	82.6	0.0	ABAZ006
DXP37031	E3-P37-D03	23-sep-1993	CSE	23.70000	8.18000	8.000	UGG	102.3	65.5	ABBC005
MRP31012	E3-P31-M01	03-dec-1993	CGW	6.07000	6.07000	8.000	UGL	75.9	0.0	ABGO008
MDP31012	E3-P31-M01	03-dec-1993	CGW	6.41000	6.41000	8.000	UGL	80.1	0.0	ABGO007
MXP31012	E3-P31-M01	03-dec-1993	CGW	6.67000	6.67000	8.000	UGL	83.4	0.0	ABGO006

Analyte: 4BFB Method: VMS1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
BX360102	E3-P36-B01	05-aug-1993	CSO	0.05800	0.05300	0.047	UGG	112.8	8.6	AALG008
BX360101	E3-P36-B01	05-aug-1993	CSO	0.05800	0.05300	0.050	UGG	106.0	7.3	AALG007
BX360201	E3-P36-B02	05-aug-1993	CSO	0.06000	0.05600	0.050	UGG	112.0	6.8	AALG009
BX360202	E3-P36-B02	05-aug-1993	CSO	0.06000	0.05300	0.050	UGG	106.0	10.7	AALG010
BX370102	E3-P37-B01	09-aug-1993	CSO	0.07200	0.05600	0.049	UGG	114.3	23.3	AAMR007
BX370101	E3-P37-B01	09-aug-1993	CSO	0.06400	0.05000	0.050	UGG	100.0	22.3	AAMR008
BX370201	E3-P37-B02	06-aug-1993	CSO	0.05300	0.05100	0.049	UGG	104.1	4.9	AAMR003
BX370202	E3-P37-B02	06-aug-1993	CSO	0.07000	0.05200	0.050	UGG	104.0	25.7	AAMR004
BR3701X1	E3-P37-B02	09-aug-1993	CSO	45.00000	45.40000	50.000	UGL	90.0	0.0	AAMS004
BV3701X1	E3-P37-D02	06-aug-1993	CSO	48.00000	47.50000	50.000	UGL	96.0	0.0	AAMS003
BV3702X1	E3-P37-B01	09-aug-1993	CSO	46.00000	45.60000	50.000	UGL	92.0	0.0	AAMS006
BX380101	E3-P38-B04	10-aug-1993	CSO	0.05700	0.05300	0.050	UGG	106.0	6.2	AANX003
BX380102	E3-P38-B04	10-aug-1993	CSO	0.07000	0.05400	0.051	UGG	105.9	22.7	AANX004
DX3902X1	E3-P39-D02	11-aug-1993	CSE	0.17000	0.04000	0.049	UGG	81.6	76.2	AANY008
DX3903X1	E3-P39-D03	11-aug-1993	CSE	0.19000	0.04300	0.050	UGG	86.0	77.9	AANY009
DX3904X1	E3-P39-D04	11-aug-1993	CSE	0.17000	0.03900	0.049	UGG	79.6	77.5	AANY010
DX3905X1	E3-P39-D05	11-aug-1993	CSE	0.18000	0.03800	0.047	UGG	80.9	78.8	AANY011
DX3906X1	E3-P39-D06	11-aug-1993	CSE	0.17000	0.03800	0.052	UGG	73.1	77.2	AANY012
BV3801X1	E3-P38-B04	10-aug-1993	CSO	51.00000	51.20000	50.000	UGL	102.0	0.0	AANZ006

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

BR3801X1	E3-P38-B04	10-aug-1993	CSO	51.00000	50.70000	50.000	UGL	102.0	0.0	AANZ003
BV3602X1	E3-P36-B03	13-aug-1993	CSO	56.00000	55.80000	50.000	UGL	112.0	0.0	AANZ012
SV3701X1	E3-P37-S01	16-aug-1993	CSO	53.00000	52.70000	50.000	UGL	106.0	0.0	AANZ013
DD3901X1	E3-P39-D01	12-aug-1993	CSE	0.20000	0.04000	0.048	UGG	83.3	79.9	AAOA012
DX3901X1	E3-P39-D01	12-aug-1993	CSE	0.24000	0.04400	0.053	UGG	83.0	81.6	AAOA013
BX360302	E3-P36-B03	13-aug-1993	CSO	0.04700	0.04300	0.045	UGG	95.6	8.7	AAOA011
BX360301	E3-P36-B03	13-aug-1993	CSO	0.04400	0.04000	0.047	UGG	85.1	7.6	AAOA010
BX370302	E3-P37-B03	16-aug-1993	CSO	0.05100	0.04200	0.047	UGG	89.4	16.2	AAQK005
BD370302	E3-P37-B03	16-aug-1993	CSO	0.05100	0.04300	0.049	UGG	87.8	15.1	AAQK003
BX370301	E3-P37-B03	16-aug-1993	CSO	0.05600	0.05400	0.050	UGG	108.0	4.5	AAQK004
SX3601X1	E3-P36-S01	25-aug-1993	CSO	0.04500	0.04300	0.047	UGG	91.5	2.4	AARX004
SD3601X1	E3-P36-S01	25-aug-1993	CSO	0.04400	0.04300	0.048	UGG	89.6	3.2	AARX005
SX3602X1	E3-P36-S02	25-aug-1993	CSO	0.04900	0.04600	0.051	UGG	90.2	6.3	AARX006
SX3603X1	E3-P36-S03	25-aug-1993	CSO	0.04900	0.04700	0.048	UGG	97.9	2.9	AARX007
SX3604X1	E3-P36-S04	25-aug-1993	CSO	0.05100	0.04800	0.048	UGG	100.0	5.2	AARX008
SX3605X1	E3-P36-S05	25-aug-1993	CSO	0.04900	0.04600	0.051	UGG	90.2	5.5	AARX009
SX3606X1	E3-P36-S06	25-aug-1993	CSO	0.04900	0.04600	0.049	UGG	93.9	7.0	AARX010
SX3607X1	E3-P36-S07	24-aug-1993	CSO	0.05600	0.04800	0.051	UGG	94.1	15.2	AARX003
SX3608X1	E3-P36-S08	25-aug-1993	CSO	0.05700	0.04800	0.050	UGG	96.0	16.6	AARX011
SX3609X1	E3-P36-S09	25-aug-1993	CSO	0.06000	0.04800	0.051	UGG	94.1	18.7	AARX012
SX3610X1	E3-P36-S10	25-aug-1993	CSO	0.05700	0.04600	0.050	UGG	92.0	18.4	AARX013
SX3611X1	E3-P36-S11	25-aug-1993	CSO	0.04800	0.04500	0.051	UGG	88.2	6.6	AARX014
SX3612X1	E3-P36-S12	25-aug-1993	CSO	0.05000	0.04500	0.049	UGG	91.8	9.2	AARY003
SX3701X1	E3-P37-S01	25-aug-1993	CSO	0.04900	0.04600	0.049	UGG	93.9	6.2	AARY004
SX3702X1	E3-P37-S02	25-aug-1993	CSO	0.05200	0.04800	0.050	UGG	96.0	7.6	AARY005
SX3703X1	E3-P37-S03	25-aug-1993	CSO	0.04700	0.04400	0.048	UGG	91.7	7.0	AARY006
SX3704X1	E3-P37-S04	25-aug-1993	CSO	0.04700	0.04500	0.050	UGG	90.0	4.9	AARY007
SX3705X1	E3-P37-S05	25-aug-1993	CSO	0.04600	0.04500	0.049	UGG	91.8	1.8	AARY008
SX3706X1	E3-P37-S06	25-aug-1993	CSO	0.04500	0.04300	0.049	UGG	87.8	3.1	AARY009
SX3801X1	E3-P38-S01	25-aug-1993	CSO	0.04200	0.04000	0.050	UGG	80.0	4.7	AARY010
SX3802X1	E3-P38-S02	25-aug-1993	CSO	0.04900	0.04700	0.047	UGG	100.0	2.6	AARY011
SX3803X1	E3-P38-S03	25-aug-1993	CSO	0.04400	0.04200	0.050	UGG	84.0	4.0	AARY012
SV3602X1	E3-P36-S07	24-aug-1993	CSO	5.00000	5.05000	50.000	UGL	10.0	0.0	AASA011
SV3601X1	E3-P36-S01	25-aug-1993	CSO	47.00000	46.80000	50.000	UGL	94.0	0.0	AASN004
SV3801X1	E3-P38-S01	25-aug-1993	CSO	47.00000	46.60000	50.000	UGL	94.0	0.0	AASN005
MXP31011	E3-P31-M01	01-sep-1993	CGW	50.00000	50.20000	50.000	UGL	100.0	0.0	AATL004
MXP36011	E3-P36-M01	01-sep-1993	CGW	49.00000	49.40000	50.000	UGL	98.0	0.0	AATL005
MXP36011	E3-P36-M01	01-sep-1993	CGW	48.00000	47.70000	50.000	UGL	96.0	0.0	AATL013
MXP36011	E3-P36-M01	01-sep-1993	CGW	50.00000	50.20000	50.000	UGL	100.0	0.0	AATL014
MXP37031	E3-P37-M03	01-sep-1993	CGW	49.00000	49.20000	50.000	UGL	98.0	0.0	AATL007
MRP37021	E3-P37-M02	02-sep-1993	CGW	49.00000	48.80000	50.000	UGL	98.0	0.0	AATV010
MVP36011	E3-P36-M01	01-sep-1993	CGW	47.00000	46.60000	50.000	UGL	94.0	0.0	AATV006
MXP36021	E3-P36-M02	02-sep-1993	CGW	46.00000	45.60000	50.000	UGL	92.0	0.0	AATV011
MDP36021	E3-P36-M02	02-sep-1993	CGW	49.00000	49.10000	50.000	UGL	98.0	0.0	AATV012
MXP36031	E3-P36-M03	02-sep-1993	CGW	48.00000	48.00000	50.000	UGL	96.0	0.0	AATV013
MXP37011	E3-P37-M01	02-sep-1993	CGW	48.00000	47.90000	50.000	UGL	96.0	0.0	AATV007
MDP37011	E3-P37-M01	02-sep-1993	CGW	48.00000	47.70000	50.000	UGL	96.0	0.0	AATV008
MXP37021	E3-P37-M02	02-sep-1993	CGW	48.00000	47.50000	50.000	UGL	96.0	0.0	AATV009
MVP37011	E3-P37-M01	02-sep-1993	CGW	48.00000	48.00000	50.000	UGL	96.0	0.0	AATX012
DXP37011	E3-P37-D01	16-sep-1993	CSE	0.22000	0.04600	0.053	UGG	86.8	79.7	AAYM008
DXP37021	E3-P37-D02	16-sep-1993	CSE	0.07200	0.05300	0.050	UGG	106.0	25.7	AAYM010

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

DXP37031	E3-P37-D03	16-sep-1993	CSE	0.27000	0.04300	0.051	UGG	84.3	84.5	AAYM009
WXP37011	E3-P37-D01	16-sep-1993	CSW	50.00000	49.70000	50.000	UGL	100.0	0.0	AAYW003
WXP37021	E3-P37-D02	16-sep-1993	CSW	46.00000	45.80000	50.000	UGL	92.0	0.0	AAYW007
WXP37031	E3-P37-D03	16-sep-1993	CSW	48.00000	48.00000	50.000	UGL	96.0	0.0	AAYW004
WVP37011	E3-P37-D01	16-sep-1993	CSW	49.00000	48.50000	50.000	UGL	98.0	0.0	AAYW008
DVP37011	E3-P37-D01	16-sep-1993	CSE	49.00000	48.80000	50.000	UGL	98.0	0.0	AAYW009
ERP31011	E3-P31-B01	24-sep-1993	CSO	48.00000	48.40000	50.000	UGL	96.0	0.0	ABBE010
EVP31021	E3-P31-B03	23-sep-1993	CSO	48.00000	48.10000	50.000	UGL	96.0	0.0	ABBE009
EXP31012	E3-P31-B01	24-sep-1993	CSO	0.03800	0.03600	0.048	UGG	75.0	5.2	ABBF004
EDP31012	E3-P31-B01	24-sep-1993	CSO	0.04400	0.04200	0.049	UGG	85.7	4.4	ABBF005
EXP31011	E3-P31-B01	24-sep-1993	CSO	0.05300	0.05000	0.049	UGG	102.0	6.4	ABBF003
EXP31022	E3-P31-B02	24-sep-1993	CSO	0.04900	0.04500	0.046	UGG	97.8	6.3	ABBF007
EXP31021	E3-P31-B02	24-sep-1993	CSO	0.04900	0.04500	0.049	UGG	91.8	7.2	ABBF006
EXP31031	E3-P31-B03	24-sep-1993	CSO	0.06100	0.04400	0.049	UGG	89.8	27.7	ABBF008
EXP38012	E3-P38-B01	24-sep-1993	CSO	0.05000	0.04600	0.048	UGG	95.8	8.3	ABBF010
EXP38011	E3-P38-B01	24-sep-1993	CSO	0.04800	0.04500	0.049	UGG	91.8	5.9	ABBF009
EXP38021	E3-P38-B02	24-sep-1993	CSO	0.04800	0.04500	0.048	UGG	93.8	4.7	ABBF011
EXP38022	E3-P38-B02	24-sep-1993	CSO	0.05000	0.04800	0.049	UGG	98.0	4.4	ABBF012
MXP37032	E3-P37-M03	01-dec-1993	CGW	52.00000	51.90000	50.000	UGL	104.0	0.0	ABGY012
MXP37022	E3-P37-M02	01-dec-1993	CGW	52.00000	52.00000	50.000	UGL	104.0	0.0	ABGY011
MXP37012	E3-P37-M01	01-dec-1993	CGW	53.00000	52.80000	50.000	UGL	106.0	0.0	ABGY010
MXP36032	E3-P36-M03	01-dec-1993	CGW	52.00000	51.50000	50.000	UGL	104.0	0.0	ABGY009
MXP36022	E3-P36-M02	01-dec-1993	CGW	51.00000	51.40000	50.000	UGL	102.0	0.0	ABGY008
MXP36012	E3-P36-M01	01-dec-1993	CGW	53.00000	52.60000	50.000	UGL	106.0	0.0	ABGY007
MVP37012	E3-P37-M01	01-dec-1993	CGW	51.00000	50.50000	50.000	UGL	102.0	0.0	ABGZ009
MRP36012	E3-P36-M01	01-dec-1993	CGW	53.00000	53.00000	50.000	UGL	106.0	0.0	ABGZ008
MRP31012	E3-P31-M01	03-dec-1993	CGW	49.00000	49.20000	50.000	UGL	98.0	0.0	ABHA012
MDP31012	E3-P31-M01	03-dec-1993	CGW	48.00000	48.40000	50.000	UGL	96.0	0.0	ABHA011
MXP31012	E3-P31-M01	03-dec-1993	CGW	51.00000	50.80000	50.000	UGL	102.0	0.0	ABHA010

Analyte: CL4XYL Method: PST1 Lab: UB

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
SX3601X1	E3-P36-S01	25-aug-1993	CSO	0.06400	0.06300	0.100	UGG	63.0	2.0	AEDT011
SD3601X1	E3-P36-S01	25-aug-1993	CSO	0.07300	0.07200	0.100	UGG	72.0	2.2	AEDT012
SX3602X1	E3-P36-S02	25-aug-1993	CSO	0.07700	0.07200	0.100	UGG	72.0	6.3	AEDT013
SX3603X1	E3-P36-S03	25-aug-1993	CSO	0.07700	0.07600	0.100	UGG	76.0	2.1	AEDT014
SX3604X1	E3-P36-S04	25-aug-1993	CSO	0.03300	0.03200	0.100	UGG	32.0	4.8	AEDT015
SX3605X1	E3-P36-S05	25-aug-1993	CSO	0.07700	0.07200	0.100	UGG	72.0	6.6	AEDT016
SX3606X1	E3-P36-S06	25-aug-1993	CSO	0.08100	0.07600	0.100	UGG	76.0	7.1	AEDT017
SX3607X1	E3-P36-S07	25-aug-1993	CSO	0.09300	0.08100	0.100	UGG	81.0	12.3	AEDT032
SX3608X1	E3-P36-S08	25-aug-1993	CSO	0.09300	0.07900	0.100	UGG	79.0	14.5	AEDT018
SX3609X1	E3-P36-S09	25-aug-1993	CSO	0.09000	0.08000	0.100	UGG	80.0	10.9	AEDT019
SX3610X1	E3-P36-S10	25-aug-1993	CSO	0.09400	0.08000	0.100	UGG	80.0	15.4	AEDT020
SX3611X1	E3-P36-S11	25-aug-1993	CSO	0.08500	0.07900	0.100	UGG	79.0	7.3	AEDT033
SX3612X1	E3-P36-S12	25-aug-1993	CSO	0.08400	0.07500	0.100	UGG	75.0	10.0	AEDT034
SX3701X1	E3-P37-S01	25-aug-1993	CSO	0.08700	0.08200	0.100	UGG	82.0	5.4	AEDT026
SX3702X1	E3-P37-S02	25-aug-1993	CSO	0.08800	0.08100	0.100	UGG	81.0	7.9	AEDT027
SX3703X1	E3-P37-S03	25-aug-1993	CSO	0.07700	0.07200	0.100	UGG	72.0	6.6	AEDT028
SX3704X1	E3-P37-S04	25-aug-1993	CSO	0.08600	0.08100	0.100	UGG	81.0	5.6	AEDT029
SX3705X1	E3-P37-S05	25-aug-1993	CSO	0.08200	0.08000	0.100	UGG	80.0	1.5	AEDT030

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

SX3706X1	E3-P37-S06	25-aug-1993	CSO	0.07600	0.07400	0.100	UGG	74.0	2.6	AEDT031
SX3801X1	E3-P38-S01	25-aug-1993	CSO	0.08300	0.07900	0.100	UGG	79.0	4.6	AEDT021
SX3801X1	E3-P38-S01	25-aug-1993	CSO	0.08200	0.07800	0.100	UGG	78.0	4.6	AEDT022
SX3801X1	E3-P38-S01	25-aug-1993	CSO	0.06500	0.06200	0.100	UGG	62.0	4.6	AEDT023
SX3802X1	E3-P38-S02	25-aug-1993	CSO	0.07400	0.07200	0.100	UGG	72.0	2.2	AEDT024
SX3803X1	E3-P38-S03	25-aug-1993	CSO	0.08100	0.07800	0.100	UGG	78.0	3.3	AEDT025
DXP37011	E3-P37-D01	16-sep-1993	CSE	0.66900	0.11900	0.100	UGG	119.0	82.2	AEQE018
DXP37021	E3-P37-D02	16-sep-1993	CSE	0.12100	0.09300	0.100	UGG	93.0	23.4	AEQE019
DXP37021	E3-P37-D02	16-sep-1993	CSE	0.13300	0.10200	0.100	UGG	102.0	23.4	AEQE020
DXP37021	E3-P37-D02	16-sep-1993	CSE	0.13200	0.10100	0.100	UGG	101.0	23.4	AEQE023
DXP37031	E3-P37-D03	16-sep-1993	CSE	0.61200	0.09300	0.100	UGG	93.0	84.8	AEQE024
EXP31011	E3-P31-B01	24-sep-1993	CSO	0.11200	0.10200	0.100	UGG	102.0	9.0	AEYR011
EXP31012	E3-P31-B01	24-sep-1993	CSO	0.11400	0.10900	0.100	UGG	109.0	4.7	AEYR012
EDP31012	E3-P31-B01	24-sep-1993	CSO	0.11700	0.11000	0.100	UGG	110.0	6.3	AEYR013
EXP31021	E3-P31-B02	24-sep-1993	CSO	0.11700	0.10700	0.100	UGG	107.0	8.8	AEYR014
EXP31022	E3-P31-B02	24-sep-1993	CSO	0.12500	0.11600	0.100	UGG	116.0	7.5	AEYR015
EXP31031	E3-P31-B03	24-sep-1993	CSO	0.15300	0.10800	0.100	UGG	108.0	29.4	AEYR016
EXP38011	E3-P38-B01	24-sep-1993	CSO	0.11400	0.10800	0.100	UGG	108.0	5.5	AEYR017
EXP38012	E3-P38-B01	24-sep-1993	CSO	0.12100	0.10800	0.100	UGG	108.0	10.4	AEYR018
EXP38021	E3-P38-B02	24-sep-1993	CSO	0.11400	0.10900	0.100	UGG	109.0	4.6	AEYR019
EXP38022	E3-P38-B02	24-sep-1993	CSO	0.12000	0.11400	0.100	UGG	114.0	5.2	AEYR020

Analyte: DBUCLE Method: PST1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
BX360101	E3-P36-B01	05-aug-1993	CSO	0.00000	0.00000	0.067	UGG	0.0	7.3	AALH016
BX360102	E3-P36-B01	05-aug-1993	CSO	0.03500	0.03200	0.067	UGG	47.8	8.6	AALH017
BX360201	E3-P36-B02	05-aug-1993	CSO	0.05600	0.02600	0.067	UGG	77.6	6.8	AALH018
BX360202	E3-P36-B02	05-aug-1993	CSO	0.05800	0.05200	0.067	UGG	77.6	10.7	AALV010
BX370201	E3-P37-B02	06-aug-1993	CSO	0.06900	0.06600	0.067	UGG	98.5	4.9	AAME010
BX370202	E3-P37-B02	06-aug-1993	CSO	0.08400	0.06300	0.067	UGG	94.0	25.7	AAME011
BX370202	E3-P37-B02	06-aug-1993	CSO	0.08100	0.06000	0.067	UGG	89.6	25.7	AAME014
BX370202	E3-P37-B02	06-aug-1993	CSO	0.08900	0.06600	0.067	UGG	98.5	25.7	AAME015
BR3601X1	E3-P36-B01	05-aug-1993	CSO	1.90000	0.95000	2.000	UGL	95.0	0.0	AAMF012
BX370102	E3-P37-B01	09-aug-1993	CSO	0.08900	0.03400	0.067	UGG	101.5	23.3	AAML010
BX370101	E3-P37-B01	09-aug-1993	CSO	0.08500	0.03300	0.067	UGG	98.5	22.3	AAML011
BR3701X1	E3-P37-B02	09-aug-1993	CSO	2.00000	1.00000	2.000	UGL	100.0	0.0	AAMM010
BR3801X1	E3-P38-B04	10-aug-1993	CSO	2.00000	1.00000	2.000	UGL	100.0	0.0	AAMM012
BX380101	E3-P38-B04	10-aug-1993	CSO	0.06600	0.06200	0.067	UGG	92.5	6.2	AANE014
BX380102	E3-P38-B04	10-aug-1993	CSO	0.07000	0.05400	0.067	UGG	80.6	22.7	AANE015
DX3906X1	E3-P39-D06	11-aug-1993	CSE	0.29000	0.00300	0.067	UGG	89.6	77.2	AANU012
DX3901X1	E3-P39-D01	11-aug-1993	CSE	0.03500	0.00600	0.067	UGG	9.0	81.6	AANV015
DD3901X1	E3-P39-D01	11-aug-1993	CSE	0.07000	0.00100	0.067	UGG	14.9	79.9	AANV016
DX3902X1	E3-P39-D02	11-aug-1993	CSE	0.12000	0.00300	0.067	UGG	44.8	76.2	AANV017
DX3903X1	E3-P39-D03	11-aug-1993	CSE	0.27000	0.00300	0.067	UGG	89.6	77.9	AANV018
DX3904X1	E3-P39-D04	11-aug-1993	CSE	LT 0.13000	0.00700	0.067	UGG	0.0	77.5	AANV019
DX3905X1	E3-P39-D05	11-aug-1993	CSE	0.29000	0.00600	0.067	UGG	89.6	78.8	AANV020
BX360301	E3-P36-B03	13-aug-1993	CSO	0.08300	0.07700	0.067	UGG	114.9	7.6	AAOR016
BX360302	E3-P36-B03	13-aug-1993	CSO	0.08700	0.08000	0.067	UGG	119.4	8.7	AAOR017
BX360301	E3-P36-B03	13-aug-1993	CSO	0.08200	0.07500	0.067	UGG	111.9	7.6	AAOR019
BX360301	E3-P36-B03	13-aug-1993	CSO	0.08200	0.07500	0.067	UGG	111.9	7.6	AAOR020

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

BD370302	E3-P37-B03	16-aug-1993	CSO	0.08900	0.07600	0.067	UGG	113.4	15.1	AAOR018
BX370301	E3-P37-B03	16-aug-1993	CSO	0.08600	0.04100	0.067	UGG	122.4	4.5	AAPE010
BX370302	E3-P37-B03	16-aug-1993	CSO	0.09100	0.01900	0.067	UGG	113.4	16.2	AAPE011
MXP31011	E3-P31-M01	01-sep-1993	CGW	2.01000	2.01000	2.000	UGL	100.5	0.0	AATN010
MXP36011	E3-P36-M01	01-sep-1993	CGW	2.40000	1.20000	2.000	UGL	120.0	0.0	AATN011
MXP36011	E3-P36-M01	01-sep-1993	CGW	2.60000	1.30000	2.000	UGL	130.0	0.0	AATN014
MXP36011	E3-P36-M01	01-sep-1993	CGW	2.40000	1.20000	2.000	UGL	120.0	0.0	AATN015
MXP37031	E3-P37-M03	01-sep-1993	CGW	2.60000	1.30000	2.000	UGL	130.0	0.0	AATN013
MRP37021	E3-P37-M02	02-sep-1993	CGW	2.60000	0.65000	2.000	UGL	130.0	0.0	AAUJ012
MXP36021	E3-P36-M02	02-sep-1993	CGW	1.79000	1.79000	2.000	UGL	89.5	0.0	AAUJ013
MDP36021	E3-P36-M02	02-sep-1993	CGW	2.08000	2.08000	2.000	UGL	104.0	0.0	AAUJ014
MXP36031	E3-P36-M03	02-sep-1993	CGW	1.62000	1.62000	2.000	UGL	81.0	0.0	AAUJ015
MDP37011	E3-P37-M01	02-sep-1993	CGW	1.92000	1.92000	2.000	UGL	96.0	0.0	AAUJ010
MXP37021	E3-P37-M02	02-sep-1993	CGW	2.18000	2.18000	2.000	UGL	109.0	0.0	AAUJ011
MXP37011	E3-P37-M01	02-sep-1993	CGW	2.32000	2.32000	2.000	UGL	116.0	0.0	AAUU010
WXP37011	E3-P37-D01	16-sep-1993	CSW	2.20000	1.10000	2.000	UGL	110.0	0.0	AAYU010
WXP37021	E3-P37-D02	16-sep-1993	CSW	2.68000	2.68000	2.000	UGL	134.0	0.0	AAYU014
WXP37021	E3-P37-D02	16-sep-1993	CSW	2.56000	2.56000	2.000	UGL	128.0	0.0	AAYU018
WXP37021	E3-P37-D02	16-sep-1993	CSW	2.61000	2.61000	2.000	UGL	130.5	0.0	AAYU019
WXP37031	E3-P37-D03	16-sep-1993	CSW	2.21000	2.21000	2.000	UGL	110.5	0.0	AAYU011
ERP31011	E3-P31-B01	24-sep-1993	CSO	2.20000	1.10000	2.000	UGL	110.0	0.0	ABBB012
MXP37032	E3-P37-M03	01-dec-1993	CGW	1.87000	1.87000	2.000	UGL	93.5	0.0	ABFK016
MXP37022	E3-P37-M02	01-dec-1993	CGW	0.62500	0.62500	2.000	UGL	31.3	0.0	ABFK015
MXP37012	E3-P37-M01	01-dec-1993	CGW	0.87600	0.87600	2.000	UGL	43.8	0.0	ABFK014
MXP36032	E3-P36-M03	01-dec-1993	CGW	1.72000	1.72000	2.380	UGL	72.3	0.0	ABFK013
MXP36022	E3-P36-M02	01-dec-1993	CGW	1.31000	1.31000	2.380	UGL	55.0	0.0	ABFK012
MXP36012	E3-P36-M01	01-dec-1993	CGW	0.54600	0.54600	2.000	UGL	27.3	0.0	ABFK011
MRP36012	E3-P36-M01	01-dec-1993	CGW	1.71000	1.71000	2.000	UGL	85.5	0.0	ABGQ013
MRP31012	E3-P31-M01	03-dec-1993	CGW	1.94000	1.94000	2.000	UGL	97.0	0.0	ABHD014
MDP31012	E3-P31-M01	03-dec-1993	CGW	1.70000	1.70000	2.000	UGL	85.0	0.0	ABHD013
MXP31012	E3-P31-M01	03-dec-1993	CGW	1.79000	1.79000	2.000	UGL	89.5	0.0	ABHD012

Analyte: DBUCLE Method: PST1 Lab: UB

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
SX3601X1	E3-P36-S01	25-aug-1993	CSO	0.21500	0.21100	0.100	UGG	211.0	2.0	AEDT011
SD3601X1	E3-P36-S01	25-aug-1993	CSO	0.20700	0.20200	0.100	UGG	202.0	2.2	AEDT012
SX3602X1	E3-P36-S02	25-aug-1993	CSO	0.09800	0.09200	0.100	UGG	92.0	6.3	AEDT013
SX3603X1	E3-P36-S03	25-aug-1993	CSO	0.09300	0.09100	0.100	UGG	91.0	2.1	AEDT014
SX3604X1	E3-P36-S04	25-aug-1993	CSO	0.05900	0.05600	0.100	UGG	56.0	4.8	AEDT015
SX3605X1	E3-P36-S05	25-aug-1993	CSO	0.10100	0.09400	0.100	UGG	94.0	6.6	AEDT016
SX3606X1	E3-P36-S06	25-aug-1993	CSO	0.11300	0.10500	0.100	UGG	105.0	7.1	AEDT017
SX3607X1	E3-P36-S07	25-aug-1993	CSO	0.18400	0.16100	0.100	UGG	161.0	12.3	AEDT032
SX3608X1	E3-P36-S08	25-aug-1993	CSO	0.10300	0.08800	0.100	UGG	88.0	14.5	AEDT018
SX3609X1	E3-P36-S09	25-aug-1993	CSO	0.10600	0.09400	0.100	UGG	94.0	10.9	AEDT019
SX3610X1	E3-P36-S10	25-aug-1993	CSO	0.16300	0.13800	0.100	UGG	138.0	15.4	AEDT020
SX3611X1	E3-P36-S11	25-aug-1993	CSO	0.10900	0.10100	0.100	UGG	101.0	7.3	AEDT033
SX3612X1	E3-P36-S12	25-aug-1993	CSO	0.47600	0.42800	0.100	UGG	428.0	10.0	AEDT034
SX3701X1	E3-P37-S01	25-aug-1993	CSO	0.10600	0.10000	0.100	UGG	100.0	5.4	AEDT026
SX3702X1	E3-P37-S02	25-aug-1993	CSO	0.10800	0.10000	0.100	UGG	100.0	7.9	AEDT027
SX3703X1	E3-P37-S03	25-aug-1993	CSO	0.09500	0.08900	0.100	UGG	89.0	6.6	AEDT028

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

SX3704X1	E3-P37-S04	25-aug-1993	CSO	0.10500	0.09900	0.100	UGG	99.0	5.6	AEDT029
SX3705X1	E3-P37-S05	25-aug-1993	CSO	0.10000	0.09900	0.100	UGG	99.0	1.5	AEDT030
SX3706X1	E3-P37-S06	25-aug-1993	CSO	0.10100	0.09800	0.100	UGG	98.0	2.6	AEDT031
SX3801X1	E3-P38-S01	25-aug-1993	CSO	0.09900	0.09400	0.100	UGG	94.0	4.6	AEDT021
SX3801X1	E3-P38-S01	25-aug-1993	CSO	0.09000	0.08600	0.100	UGG	86.0	4.6	AEDT022
SX3801X1	E3-P38-S01	25-aug-1993	CSO	0.08100	0.07700	0.100	UGG	77.0	4.6	AEDT023
SX3801X1	E3-P38-S01	25-aug-1993	CSO	0.09700	0.09500	0.100	UGG	95.0	2.2	AEDT024
SX3802X1	E3-P38-S02	25-aug-1993	CSO	0.10500	0.10200	0.100	UGG	102.0	3.3	AEDT025
SX3803X1	E3-P38-S03	25-aug-1993	CSO	0.72500	0.12900	0.100	UGG	129.0	82.2	AEQE018
DXP37011	E3-P37-D01	16-sep-1993	CSE	0.13000	0.09900	0.100	UGG	99.0	23.4	AEQE019
DXP37021	E3-P37-D02	16-sep-1993	CSE	0.10400	0.08000	0.100	UGG	80.0	23.4	AEQE020
DXP37021	E3-P37-D02	16-sep-1993	CSE	0.12400	0.09500	0.100	UGG	95.0	23.4	AEQE023
DXP37021	E3-P37-D02	16-sep-1993	CSE	0.62600	0.09500	0.100	UGG	95.0	84.8	AEQE024
DXP37031	E3-P37-D03	16-sep-1993	CSE	0.11300	0.10300	0.100	UGG	103.0	9.0	AEYR011
EXP31011	E3-P31-B01	24-sep-1993	CSO	0.11900	0.11300	0.100	UGG	113.0	4.7	AEYR012
EXP31012	E3-P31-B01	24-sep-1993	CSO	0.11000	0.10300	0.100	UGG	103.0	6.3	AEYR013
EDP31012	E3-P31-B01	24-sep-1993	CSO	0.11400	0.10400	0.100	UGG	104.0	8.8	AEYR014
EXP31021	E3-P31-B02	24-sep-1993	CSO	0.12300	0.11400	0.100	UGG	114.0	7.5	AEYR015
EXP31022	E3-P31-B02	24-sep-1993	CSO	0.17000	0.12000	0.100	UGG	120.0	29.4	AEYR016
EXP31031	E3-P31-B03	24-sep-1993	CSO	0.11700	0.11100	0.100	UGG	111.0	5.5	AEYR017
EXP38011	E3-P38-B01	24-sep-1993	CSO	0.11500	0.10300	0.100	UGG	103.0	10.4	AEYR018
EXP38012	E3-P38-B01	24-sep-1993	CSO	0.12100	0.11500	0.100	UGG	115.0	4.6	AEYR019
EXP38021	E3-P38-B02	24-sep-1993	CSO	0.13100	0.12400	0.100	UGG	124.0	5.2	AEYR020
EXP38022	E3-P38-B02	24-sep-1993	CSO							

Analyte: ISODR Method: PST1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
BX360101	E3-P36-B01	05-aug-1993	CSO	0.00300	0.00200	0.013	UGG	15.4	7.3	AALH016
BX360102	E3-P36-B01	05-aug-1993	CSO	0.00300	0.00200	0.013	UGG	15.4	8.6	AALH017
BX360201	E3-P36-B02	05-aug-1993	CSO	0.00400	0.00200	0.013	UGG	30.8	6.8	AALH018
BX360202	E3-P36-B02	05-aug-1993	CSO	0.01100	0.01000	0.013	UGG	76.9	10.7	AALV010
BX370201	E3-P37-B02	06-aug-1993	CSO	0.01500	0.01400	0.013	UGG	107.7	4.9	AAME010
BX370202	E3-P37-B02	06-aug-1993	CSO	0.01600	0.01200	0.013	UGG	92.3	25.7	AAME011
BX370202	E3-P37-B02	06-aug-1993	CSO	0.01600	0.01200	0.013	UGG	92.3	25.7	AAME014
BX370202	E3-P37-B02	06-aug-1993	CSO	0.01700	0.01200	0.013	UGG	92.3	25.7	AAME015
BR3601X1	E3-P36-B01	05-aug-1993	CSO	0.38000	0.19000	0.400	UGL	95.0	0.0	AAMF012
BX370102	E3-P37-B01	09-aug-1993	CSO	0.01300	0.00500	0.013	UGG	76.9	23.3	AAML010
BX370101	E3-P37-B01	09-aug-1993	CSO	0.00400	0.00200	0.013	UGG	30.8	22.3	AAML011
BR3701X1	E3-P37-B02	09-aug-1993	CSO	0.44000	0.22000	0.400	UGL	110.0	0.0	AAMM010
BR3801X1	E3-P38-B04	10-aug-1993	CSO	0.44000	0.22000	0.400	UGL	110.0	0.0	AAMM012
BX380101	E3-P38-B04	10-aug-1993	CSO	0.01200	0.01100	0.013	UGG	84.6	6.2	AANE014
BX380102	E3-P38-B04	10-aug-1993	CSO	0.00800	0.00600	0.013	UGG	46.2	22.7	AANE015
DX3906X1	E3-P39-D06	11-aug-1993	CSE	0.07400	0.00100	0.013	UGG	153.9	77.2	AANU012
DX3901X1	E3-P39-D01	11-aug-1993	CSE	0.01100	0.00200	0.013	UGG	15.4	81.6	AANV015
DD3901X1	E3-P39-D01	11-aug-1993	CSE	0.02000	4.00000	0.013	UGG	***.*	79.9	AANV016
DX3902X1	E3-P39-D02	11-aug-1993	CSE	0.04200	0.00100	0.013	UGG	76.9	76.2	AANV017
DX3903X1	E3-P39-D03	11-aug-1993	CSE	0.06300	0.00100	0.013	UGG	153.9	77.9	AANV018
DX3904X1	E3-P39-D04	11-aug-1993	CSE	0.05500	0.00100	0.013	UGG	153.9	77.5	AANV019
DX3905X1	E3-P39-D05	11-aug-1993	CSE	0.05700	0.00100	0.013	UGG	76.9	78.8	AANV020
BX360301	E3-P36-B03	13-aug-1993	CSO	0.00800	0.00700	0.013	UGG	53.9	7.6	AAOR016
BX360302	E3-P36-B03	13-aug-1993	CSO	0.00800	0.00700	0.013	UGG	53.9	8.7	AAOR017

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

BX360301	E3-P36-B03	13-aug-1993	CSO	0.00800	0.00700	0.013	UGG	53.9	7.6	AAOR019
BX360301	E3-P36-B03	13-aug-1993	CSO	0.00800	0.00800	0.013	UGG	61.5	7.6	AAOR020
BD370302	E3-P37-B03	16-aug-1993	CSO	0.00800	0.00700	0.013	UGG	53.9	15.1	AAOR018
BX370301	E3-P37-B03	16-aug-1993	CSO	0.01300	0.00600	0.013	UGG	92.3	4.5	AAPE010
BX370302	E3-P37-B03	16-aug-1993	CSO	0.01400	0.00300	0.013	UGG	92.3	16.2	AAPE011
MXP31011	E3-P31-M01	01-sep-1993	CGW	0.38800	0.38800	0.400	UGL	97.0	0.0	AATN010
MXP36011	E3-P36-M01	01-sep-1993	CGW	0.64000	0.32000	0.400	UGL	160.0	0.0	AATN011
MXP36011	E3-P36-M01	01-sep-1993	CGW	0.48000	0.24000	0.400	UGL	120.0	0.0	AATN014
MXP36011	E3-P36-M01	01-sep-1993	CGW	0.50000	0.25000	0.400	UGL	125.0	0.0	AATN015
MXP37031	E3-P37-M03	01-sep-1993	CGW	0.40000	0.20000	0.400	UGL	100.0	0.0	AATN013
MRP37021	E3-P37-M02	02-sep-1993	CGW	0.40000	0.10000	0.400	UGL	100.0	0.0	AAUJ012
MXP36021	E3-P36-M02	02-sep-1993	CGW	0.30500	0.30500	0.400	UGL	76.3	0.0	AAUJ013
MDP36021	E3-P36-M02	02-sep-1993	CGW	0.32500	0.32500	0.400	UGL	81.3	0.0	AAUJ014
MXP36031	E3-P36-M03	02-sep-1993	CGW	0.30400	0.30400	0.400	UGL	76.0	0.0	AAUJ015
MDP37011	E3-P37-M01	02-sep-1993	CGW	0.31100	0.31100	0.400	UGL	77.8	0.0	AAUJ010
MXP37021	E3-P37-M02	02-sep-1993	CGW	0.33400	0.33400	0.400	UGL	83.5	0.0	AAUJ011
MXP37011	E3-P37-M01	02-sep-1993	CGW	0.33900	0.33900	0.400	UGL	84.8	0.0	AAUU010
WXP37011	E3-P37-D01	16-sep-1993	CSW	0.32000	0.16000	0.400	UGL	80.0	0.0	AAYU010
WXP37021	E3-P37-D02	16-sep-1993	CSW	0.40100	0.40100	0.400	UGL	100.3	0.0	AAYU014
WXP37021	E3-P37-D02	16-sep-1993	CSW	0.38600	0.38600	0.400	UGL	96.5	0.0	AAYU018
WXP37021	E3-P37-D02	16-sep-1993	CSW	0.41600	0.41600	0.400	UGL	104.0	0.0	AAYU019
WXP37031	E3-P37-D03	16-sep-1993	CSW	0.34000	0.34000	0.400	UGL	85.0	0.0	AAYU011
ERP31011	E3-P31-B01	24-sep-1993	CSO	0.32000	0.16000	0.400	UGL	80.0	0.0	ABBB012
MXP37032	E3-P37-M03	01-dec-1993	CGW	0.36800	0.36800	0.400	UGL	92.0	0.0	ABFK016
MXP37022	E3-P37-M02	01-dec-1993	CGW	0.23400	0.23400	0.400	UGL	58.5	0.0	ABFK015
MXP37012	E3-P37-M01	01-dec-1993	CGW	0.24400	0.24400	0.400	UGL	61.0	0.0	ABFK014
MXP36032	E3-P36-M03	01-dec-1993	CGW	0.35500	0.35500	0.471	UGL	75.4	0.0	ABFK013
MXP36022	E3-P36-M02	01-dec-1993	CGW	0.32100	0.32100	0.476	UGL	67.4	0.0	ABFK012
MXP36012	E3-P36-M01	01-dec-1993	CGW	0.19500	0.19500	0.400	UGL	48.8	0.0	ABFK011
MRP36012	E3-P36-M01	01-dec-1993	CGW	0.28100	0.28100	0.400	UGL	70.3	0.0	ABGQ013
MRP31012	E3-P31-M01	03-dec-1993	CGW	0.34700	0.34700	0.400	UGL	86.8	0.0	ABHD014
MDP31012	E3-P31-M01	03-dec-1993	CGW	0.32600	0.32600	0.400	UGL	81.5	0.0	ABHD013
MXP31012	E3-P31-M01	03-dec-1993	CGW	0.35200	0.35200	0.400	UGL	88.0	0.0	ABHD012

Analyte: MEC6D8 Method: VMS1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
BX360102	E3-P36-B01	05-aug-1993	CSO	0.05500	0.05000	0.047	UGG	106.4	8.6	AALG008
BX360101	E3-P36-B01	05-aug-1993	CSO	0.05800	0.05400	0.050	UGG	108.0	7.3	AALG007
BX360201	E3-P36-B02	05-aug-1993	CSO	0.05500	0.05100	0.050	UGG	102.0	6.8	AALG009
BX360202	E3-P36-B02	05-aug-1993	CSO	0.05700	0.05100	0.050	UGG	102.0	10.7	AALG010
BX370102	E3-P37-B01	09-aug-1993	CSO	0.07700	0.05900	0.049	UGG	120.4	23.3	AAMR007
BX370101	E3-P37-B01	09-aug-1993	CSO	0.06300	0.04900	0.050	UGG	98.0	22.3	AAMR008
BX370201	E3-P37-B02	06-aug-1993	CSO	0.05400	0.05100	0.049	UGG	104.1	4.9	AAMR003
BX370202	E3-P37-B02	06-aug-1993	CSO	0.06900	0.05100	0.050	UGG	102.0	25.7	AAMR004
BR3701X1	E3-P37-B02	09-aug-1993	CSO	49.00000	48.70000	50.000	UGL	98.0	0.0	AAMS004
BV3701X1	E3-P37-D02	06-aug-1993	CSO	49.00000	48.90000	50.000	UGL	98.0	0.0	AAMS003
BV3702X1	E3-P37-B01	09-aug-1993	CSO	49.00000	48.60000	50.000	UGL	98.0	0.0	AAMS006
BX380101	E3-P38-B04	10-aug-1993	CSO	0.05900	0.05500	0.050	UGG	110.0	6.2	AANX003
BX380102	E3-P38-B04	10-aug-1993	CSO	0.07200	0.05500	0.051	UGG	107.8	22.7	AANX004
DX3902X1	E3-P39-D02	11-aug-1993	CSE	0.26000	0.06200	0.049	UGG	126.5	76.2	AANY008

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

DX3903X1	E3-P39-D03	11-aug-1993	CSE	0.27000	0.06000	0.050	UGG	120.0	77.9	AANY009
DX3904X1	E3-P39-D04	11-aug-1993	CSE	0.24000	0.05400	0.049	UGG	110.2	77.5	AANY010
DX3905X1	E3-P39-D05	11-aug-1993	CSE	0.28000	0.06000	0.047	UGG	127.7	78.8	AANY011
DX3906X1	E3-P39-D06	11-aug-1993	CSE	0.28000	0.06300	0.052	UGG	121.2	77.2	AANY012
BV3801X1	E3-P38-B04	10-aug-1993	CSO	51.00000	51.00000	50.000	UGL	102.0	0.0	AANZ006
BR3801X1	E3-P38-B04	10-aug-1993	CSO	51.00000	50.60000	50.000	UGL	102.0	0.0	AANZ003
BV3602X1	E3-P36-B03	13-aug-1993	CSO	52.00000	52.10000	50.000	UGL	104.0	0.0	AANZ012
SV3701X1	E3-P37-S01	16-aug-1993	CSO	50.00000	50.40000	50.000	UGL	100.0	0.0	AANZ013
DD3901X1	E3-P39-D01	12-aug-1993	CSE	0.34000	0.06800	0.048	UGG	141.7	79.9	AAOA012
DX3901X1	E3-P39-D01	12-aug-1993	CSE	0.39000	0.07200	0.053	UGG	135.9	81.6	AAOA013
BX360302	E3-P36-B03	13-aug-1993	CSO	0.04600	0.04200	0.045	UGG	93.3	8.7	AAOA011
BX360301	E3-P36-B03	13-aug-1993	CSO	0.04500	0.04100	0.047	UGG	87.2	7.6	AAOA010
BX370302	E3-P37-B03	16-aug-1993	CSO	0.05000	0.04200	0.047	UGG	89.4	16.2	AAQK005
BD370302	E3-P37-B03	16-aug-1993	CSO	0.05000	0.04200	0.049	UGG	85.7	15.1	AAQK003
BX370301	E3-P37-B03	16-aug-1993	CSO	0.05600	0.05300	0.050	UGG	106.0	4.5	AAQK004
SX3601X1	E3-P36-S01	25-aug-1993	CSO	0.05200	0.05000	0.047	UGG	106.4	2.4	AARX004
SD3601X1	E3-P36-S01	25-aug-1993	CSO	0.05600	0.05500	0.048	UGG	114.6	3.2	AARX005
SX3602X1	E3-P36-S02	25-aug-1993	CSO	0.05800	0.05400	0.051	UGG	105.9	6.3	AARX006
SX3603X1	E3-P36-S03	25-aug-1993	CSO	0.05700	0.05500	0.048	UGG	114.6	2.9	AARX007
SX3604X1	E3-P36-S04	25-aug-1993	CSO	0.05900	0.05600	0.048	UGG	116.7	5.2	AARX008
SX3605X1	E3-P36-S05	25-aug-1993	CSO	0.05900	0.05600	0.051	UGG	109.8	5.5	AARX009
SX3606X1	E3-P36-S06	25-aug-1993	CSO	0.05800	0.05400	0.049	UGG	110.2	7.0	AARX010
SX3607X1	E3-P36-S07	24-aug-1993	CSO	0.06300	0.05400	0.051	UGG	105.9	15.2	AARX003
SX3608X1	E3-P36-S08	25-aug-1993	CSO	0.06600	0.05500	0.050	UGG	110.0	16.6	AARX011
SX3609X1	E3-P36-S09	25-aug-1993	CSO	0.06400	0.05200	0.051	UGG	102.0	18.7	AARX012
SX3610X1	E3-P36-S10	25-aug-1993	CSO	0.06500	0.05300	0.050	UGG	106.0	18.4	AARX013
SX3611X1	E3-P36-S11	25-aug-1993	CSO	0.06500	0.06100	0.051	UGG	119.6	6.6	AARX014
SX3612X1	E3-P36-S12	25-aug-1993	CSO	0.05800	0.05300	0.049	UGG	108.2	9.2	AARY003
SX3701X1	E3-P37-S01	25-aug-1993	CSO	0.05500	0.05200	0.049	UGG	106.1	6.2	AARY004
SX3702X1	E3-P37-S02	25-aug-1993	CSO	0.05900	0.05500	0.050	UGG	110.0	7.6	AARY005
SX3703X1	E3-P37-S03	25-aug-1993	CSO	0.05600	0.05200	0.048	UGG	108.3	7.0	AARY006
SX3704X1	E3-P37-S04	25-aug-1993	CSO	0.05900	0.05600	0.050	UGG	112.0	4.9	AARY007
SX3705X1	E3-P37-S05	25-aug-1993	CSO	0.05400	0.05300	0.049	UGG	108.2	1.8	AARY008
SX3706X1	E3-P37-S06	25-aug-1993	CSO	0.05500	0.05300	0.049	UGG	108.2	3.1	AARY009
SX3801X1	E3-P38-S01	25-aug-1993	CSO	0.05900	0.05600	0.050	UGG	112.0	4.7	AARY010
SX3802X1	E3-P38-S02	25-aug-1993	CSO	0.05400	0.05300	0.047	UGG	112.8	2.6	AARY011
SX3803X1	E3-P38-S03	25-aug-1993	CSO	0.04700	0.04500	0.050	UGG	90.0	4.0	AARY012
SV3602X1	E3-P36-S07	24-aug-1993	CSO	52.00000	51.60000	50.000	UGL	104.0	0.0	AASA011
SV3601X1	E3-P36-S01	25-aug-1993	CSO	48.00000	48.20000	50.000	UGL	96.0	0.0	AASN004
SV3801X1	E3-P38-S01	25-aug-1993	CSO	49.00000	48.50000	50.000	UGL	98.0	0.0	AASN005
MXP31011	E3-P31-M01	01-sep-1993	CGW	50.00000	49.90000	50.000	UGL	100.0	0.0	AATL004
MXP36011	E3-P36-M01	01-sep-1993	CGW	49.00000	49.40000	50.000	UGL	98.0	0.0	AATL005
MXP36011	E3-P36-M01	01-sep-1993	CGW	50.00000	50.10000	50.000	UGL	100.0	0.0	AATL013
MXP36011	E3-P36-M01	01-sep-1993	CGW	50.00000	49.50000	50.000	UGL	100.0	0.0	AATL014
MXP37031	E3-P37-M03	01-sep-1993	CGW	50.00000	50.00000	50.000	UGL	100.0	0.0	AATL007
MRP37021	E3-P37-M02	02-sep-1993	CGW	49.00000	49.40000	50.000	UGL	98.0	0.0	AATV010
MVP36011	E3-P36-M01	01-sep-1993	CGW	49.00000	49.10000	50.000	UGL	98.0	0.0	AATV006
MXP36021	E3-P36-M02	02-sep-1993	CGW	50.00000	50.00000	50.000	UGL	100.0	0.0	AATV011
MDP36021	E3-P36-M02	02-sep-1993	CGW	52.00000	52.40000	50.000	UGL	104.0	0.0	AATV012
MXP36031	E3-P36-M03	02-sep-1993	CGW	51.00000	50.80000	50.000	UGL	102.0	0.0	AATV013
MXP37011	E3-P37-M01	02-sep-1993	CGW	50.00000	49.80000	50.000	UGL	100.0	0.0	AATV007

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

MDP37011	E3-P37-M01	02-sep-1993	CGW	51.00000	51.30000	50.000	UGL	102.0	0.0	AATV008
MXP37021	E3-P37-M02	02-sep-1993	CGW	51.00000	50.90000	50.000	UGL	102.0	0.0	AATV009
MVP37011	E3-P37-M01	02-sep-1993	CGW	50.00000	49.80000	50.000	UGL	100.0	0.0	AATX012
DXP37011	E3-P37-D01	16-sep-1993	CSE	0.28000	0.05700	0.053	UGG	107.6	79.7	AAYM008
DXP37021	E3-P37-D02	16-sep-1993	CSE	0.07000	0.05200	0.050	UGG	104.0	25.7	AAYM010
DXP37031	E3-P37-D03	16-sep-1993	CSE	0.34000	0.05300	0.051	UGG	103.9	84.5	AAYM009
WXP37011	E3-P37-D01	16-sep-1993	CSW	51.00000	51.20000	50.000	UGL	102.0	0.0	AAYW003
WXP37021	E3-P37-D02	16-sep-1993	CSW	50.00000	49.70000	50.000	UGL	100.0	0.0	AAYW007
WXP37031	E3-P37-D03	16-sep-1993	CSW	50.00000	50.20000	50.000	UGL	100.0	0.0	AAYW004
WVP37011	E3-P37-D01	16-sep-1993	CSW	51.00000	51.10000	50.000	UGL	102.0	0.0	AAYW008
DVP37011	E3-P37-D01	16-sep-1993	CSE	50.00000	50.40000	50.000	UGL	100.0	0.0	AAYW009
ERP31011	E3-P31-B01	24-sep-1993	CSO	51.00000	51.40000	50.000	UGL	102.0	0.0	ABBE010
EVP31021	E3-P31-B03	23-sep-1993	CSO	52.00000	52.20000	50.000	UGL	104.0	0.0	ABBE009
EXP31012	E3-P31-B01	24-sep-1993	CSO	0.04800	0.04500	0.048	UGG	93.8	5.2	ABBF004
EDP31012	E3-P31-B01	24-sep-1993	CSO	0.05600	0.05400	0.049	UGG	110.2	4.4	ABBF005
EXP31011	E3-P31-B01	24-sep-1993	CSO	0.05700	0.05400	0.049	UGG	110.2	6.4	ABBF003
EXP31022	E3-P31-B02	24-sep-1993	CSO	0.05700	0.05300	0.046	UGG	115.2	6.3	ABBF007
EXP31021	E3-P31-B02	24-sep-1993	CSO	0.05900	0.05400	0.049	UGG	110.2	7.2	ABBF006
EXP31031	E3-P31-B03	24-sep-1993	CSO	0.07200	0.05200	0.049	UGG	106.1	27.7	ABBF008
EXP38012	E3-P38-B01	24-sep-1993	CSO	0.05600	0.05200	0.048	UGG	108.3	8.3	ABBF010
EXP38011	E3-P38-B01	24-sep-1993	CSO	0.07000	0.06600	0.049	UGG	134.7	5.9	ABBF009
EXP38021	E3-P38-B02	24-sep-1993	CSO	0.05600	0.05400	0.048	UGG	112.5	4.7	ABBF011
EXP38022	E3-P38-B02	24-sep-1993	CSO	0.05200	0.04900	0.049	UGG	100.0	4.4	ABBF012
MXP37032	E3-P37-M03	01-dec-1993	CGW	51.00000	50.80000	50.000	UGL	102.0	0.0	ABGY012
MXP37022	E3-P37-M02	01-dec-1993	CGW	52.00000	51.70000	50.000	UGL	104.0	0.0	ABGY011
MXP37012	E3-P37-M01	01-dec-1993	CGW	52.00000	52.30000	50.000	UGL	104.0	0.0	ABGY010
MXP36032	E3-P36-M03	01-dec-1993	CGW	50.00000	50.00000	50.000	UGL	100.0	0.0	ABGY009
MXP36022	E3-P36-M02	01-dec-1993	CGW	52.00000	51.60000	50.000	UGL	104.0	0.0	ABGY008
MXP36012	E3-P36-M01	01-dec-1993	CGW	51.00000	50.80000	50.000	UGL	102.0	0.0	ABGY007
MVP37012	E3-P37-M01	01-dec-1993	CGW	50.00000	50.00000	50.000	UGL	100.0	0.0	ABGZ009
MRP36012	E3-P36-M01	01-dec-1993	CGW	53.00000	53.00000	50.000	UGL	106.0	0.0	ABGZ008
MRP31012	E3-P31-M01	03-dec-1993	CGW	47.00000	46.80000	50.000	UGL	94.0	0.0	ABHA012
MDP31012	E3-P31-M01	03-dec-1993	CGW	48.00000	48.30000	50.000	UGL	96.0	0.0	ABHA011
MXP31012	E3-P31-M01	03-dec-1993	CGW	48.00000	48.40000	50.000	UGL	96.0	0.0	ABHA010

Analyte: NBD5 Method: SMV1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
BX360101	E3-P36-B01	05-aug-1993	CSO	0.41000	0.38300	1.670	UGG	22.9	7.3	AAMG005
BX360102	E3-P36-B01	05-aug-1993	CSO	0.16000	0.15000	1.670	UGG	9.0	8.6	AAMG006
BX360201	E3-P36-B02	05-aug-1993	CSO	0.09500	0.08900	1.670	UGG	5.3	6.8	AAMG007
BX360202	E3-P36-B02	05-aug-1993	CSO	0.10000	0.09100	1.670	UGG	5.5	10.7	AAMG008
BX370201	E3-P37-B02	06-aug-1993	CSO	0.05900	0.05600	1.670	UGG	3.4	4.9	AAMG009
BX370202	E3-P37-B02	06-aug-1993	CSO	0.09900	0.07300	1.670	UGG	4.4	25.7	AAMG010
BX370102	E3-P37-B01	09-aug-1993	CSO	1.40000	1.08000	1.670	UGG	64.7	23.3	AAMN003
BX370101	E3-P37-B01	09-aug-1993	CSO	1.40000	1.11000	1.670	UGG	66.5	22.3	AAMN004
BR3701X1	E3-P37-B02	09-aug-1993	CSO	63.00000	63.40000	100.000	UGL	63.0	0.0	AAND003
BR3801X1	E3-P38-B04	10-aug-1993	CSO	64.00000	64.40000	100.000	UGL	64.0	0.0	AAND005
BX380101	E3-P38-B04	10-aug-1993	CSO	0.11000	0.09900	1.670	UGG	5.9	6.2	AANO005
BX380102	E3-P38-B04	10-aug-1993	CSO	0.04800	0.03700	1.670	UGG	2.2	22.7	AANO006
DX3901X1	E3-P39-D01	11-aug-1993	CSE	3.00000	0.09800	1.700	UGG	28.8	81.6	AANP007

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

DD3901X1	E3-P39-D01	11-aug-1993	CSE	2.00000	0.07600	1.700	UGG	22.4	79.9	AANP008
DX3902X1	E3-P39-D02	11-aug-1993	CSE	2.00000	0.11000	1.700	UGG	32.4	76.2	AANP009
DX3903X1	E3-P39-D03	11-aug-1993	CSE	4.00000	0.16000	1.700	UGG	47.1	77.9	AANP010
DX3904X1	E3-P39-D04	11-aug-1993	CSE	3.00000	0.12000	1.700	UGG	35.3	77.5	AANP011
DX3906X1	E3-P39-D06	11-aug-1993	CSE	2.00000	0.11000	1.700	UGG	32.4	77.2	AANP013
BX360301	E3-P36-B03	13-aug-1993	CSO	0.25000	0.22800	1.670	UGG	13.7	7.6	AAOS010
BX360302	E3-P36-B03	13-aug-1993	CSO	0.21000	0.18800	1.670	UGG	11.3	8.7	AAOS011
BD370302	E3-P37-B03	16-aug-1993	CSO	0.11000	0.09300	1.670	UGG	5.6	15.1	AAOS012
BX370301	E3-P37-B03	16-aug-1993	CSO	0.26000	0.25300	1.670	UGG	15.2	4.5	AAOS013
BX370302	E3-P37-B03	16-aug-1993	CSO	0.33000	0.27800	1.670	UGG	16.7	16.2	AAOS014
SX3607X1	E3-P36-S07	24-aug-1993	CSO	0.49000	0.41700	1.670	UGG	25.0	15.2	AART011
SX3601X1	E3-P36-S01	25-aug-1993	CSO	0.30000	0.03200	1.700	UGG	18.8	2.4	AASH003
SD3601X1	E3-P36-S01	25-aug-1993	CSO	0.60000	0.05600	1.700	UGG	32.9	3.2	AASH004
SX3602X1	E3-P36-S02	25-aug-1993	CSO	0.20000	0.19000	1.670	UGG	11.4	6.3	AASH005
SX3603X1	E3-P36-S03	25-aug-1993	CSO	0.33000	0.31800	1.670	UGG	19.0	2.9	AASH006
SX3604X1	E3-P36-S04	25-aug-1993	CSO	0.08100	0.07700	1.670	UGG	4.6	5.2	AASH007
SX3605X1	E3-P36-S05	25-aug-1993	CSO	0.32000	0.29900	1.670	UGG	17.9	5.5	AASH008
SX3606X1	E3-P36-S06	25-aug-1993	CSO	0.17000	0.16100	1.670	UGG	9.6	7.0	AASH009
SX3608X1	E3-P36-S08	25-aug-1993	CSO	0.43000	0.35500	1.670	UGG	21.3	16.6	AASH010
SX3704X1	E3-P37-S04	25-aug-1993	CSO	1.20000	1.10000	1.670	UGG	65.9	4.9	AASI010
SX3703X1	E3-P37-S03	25-aug-1993	CSO	0.86000	0.80300	1.670	UGG	48.1	7.0	AASI009
SX3702X1	E3-P37-S02	25-aug-1993	CSO	1.30000	1.18000	1.670	UGG	70.7	7.6	AASI008
SX3701X1	E3-P37-S01	25-aug-1993	CSO	1.20000	1.17000	1.670	UGG	70.1	6.2	AASI007
SX3612X1	E3-P36-S12	25-aug-1993	CSO	0.80000	0.02900	1.700	UGG	42.7	9.2	AASI006
SX3611X1	E3-P36-S11	25-aug-1993	CSO	1.00000	0.22000	1.700	UGG	64.7	6.6	AASI005
SX3609X1	E3-P36-S09	25-aug-1993	CSO	1.30000	1.08000	1.670	UGG	64.7	18.7	AASI003
SX3705X1	E3-P37-S05	25-aug-1993	CSO	0.47000	0.46100	1.670	UGG	27.6	1.8	AASP003
SX3706X1	E3-P37-S06	25-aug-1993	CSO	0.32000	0.31100	1.670	UGG	18.6	3.1	AASP004
SX3801X1	E3-P38-S01	25-aug-1993	CSO	0.65000	0.61600	1.670	UGG	36.9	4.7	AASP005
SX3802X1	E3-P38-S02	25-aug-1993	CSO	0.86000	0.83400	1.670	UGG	49.9	2.6	AASP006
SX3803X1	E3-P38-S03	25-aug-1993	CSO	1.00000	0.97200	1.670	UGG	58.2	4.0	AASP007
MXP31011	E3-P31-M01	01-sep-1993	CGW	66.00000	65.90000	100.000	UGL	66.0	0.0	AATS009
MXP36011	E3-P36-M01	01-sep-1993	CGW	71.00000	70.60000	100.000	UGL	71.0	0.0	AATS010
MXP37031	E3-P37-M03	01-sep-1993	CGW	75.00000	74.70000	100.000	UGL	75.0	0.0	AATS012
MRP37021	E3-P37-M02	02-sep-1993	CGW	72.00000	71.50000	115.000	UGL	62.6	0.0	AAUF005
MDP36021	E3-P36-M02	02-sep-1993	CGW	70.00000	70.00000	100.000	UGL	70.0	0.0	AAUF007
MXP36021	E3-P36-M02	02-sep-1993	CGW	77.00000	77.40000	112.000	UGL	68.8	0.0	AAUF006
MXP36031	E3-P36-M03	02-sep-1993	CGW	100.00000	99.60000	133.000	UGL	75.2	0.0	AAUF008
MDP37011	E3-P37-M01	02-sep-1993	CGW	66.00000	66.00000	100.000	UGL	66.0	0.0	AAUF003
MXP37021	E3-P37-M02	02-sep-1993	CGW	68.00000	67.60000	100.000	UGL	68.0	0.0	AAUF004
SX3610X1	E3-P36-S10	03-sep-1993	CSO	0.79000	0.74200	1.670	UGG	44.4	6.4	AAUV003
MXP37011	E3-P37-M01	02-sep-1993	CGW	81.00000	80.60000	100.000	UGL	81.0	0.0	AAUW003
WXP37011	E3-P37-D01	16-sep-1993	CSW	47.00000	47.30000	100.000	UGL	47.0	0.0	AAYQ008
WXP37021	E3-P37-D02	16-sep-1993	CSW	53.00000	53.40000	112.000	UGL	47.3	0.0	AAYQ012
WXP37031	E3-P37-D03	16-sep-1993	CSW	68.00000	68.10000	100.000	UGL	68.0	0.0	AAYQ009
DXP37011	E3-P37-D01	16-sep-1993	CSE	2.60000	0.53800	1.670	UGG	32.2	79.7	AAYZ003
DXP37021	E3-P37-D02	16-sep-1993	CSE	0.58000	0.43400	1.670	UGG	26.0	25.7	AAYZ005
DXP37031	E3-P37-D03	16-sep-1993	CSE	4.70000	0.73500	1.670	UGG	44.0	84.5	AAYZ004
ERP31011	E3-P31-B01	24-sep-1993	CSO	76.00000	76.10000	100.000	UGL	76.0	0.0	ABAK011
BXP37041	E3-P37-B04	01-dec-1993	CSO	1.20000	1.08000	1.670	UGG	64.7	11.2	ABFT003
BXP37042	E3-P37-B04	01-dec-1993	CSO	1.20000	1.02000	1.670	UGG	61.1	13.3	ABFT004

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

BXP38031	E3-P38-B03	01-dec-1993	CSO	1.10000	0.94600	1.670	UGG	56.7	10.0	ABFT005
BXP38032	E3-P38-B03	01-dec-1993	CSO	1.20000	0.98200	1.670	UGG	58.8	21.2	ABFT006
MXP36012	E3-P36-M01	01-dec-1993	CGW	82.00000	81.80000	100.000	UGL	82.0	0.0	ABFV004
MXP36022	E3-P36-M02	01-dec-1993	CGW	88.00000	88.40000	100.000	UGL	88.0	0.0	ABFV005
MXP36032	E3-P36-M03	01-dec-1993	CGW	92.00000	92.00000	100.000	UGL	92.0	0.0	ABFV006
MXP37012	E3-P37-M01	01-dec-1993	CGW	60.00000	60.30000	100.000	UGL	60.0	0.0	ABFV007
MXP37022	E3-P37-M02	01-dec-1993	CGW	81.00000	80.90000	100.000	UGL	81.0	0.0	ABFV008
MXP37032	E3-P37-M03	01-dec-1993	CGW	90.00000	90.40000	100.000	UGL	90.0	0.0	ABFV009
SXP36122	E3-P36-S12	02-dec-1993	CSO	1.00000	0.20000	1.700	UGG	58.8	8.0	ABGL005
MRP36012	E3-P36-M01	01-dec-1993	CGW	71.00000	70.80000	100.000	UGL	71.0	0.0	ABGM004
MRP31012	E3-P31-M01	03-dec-1993	CGW	57.00000	56.90000	100.000	UGL	57.0	0.0	ABHC006
MDP31012	E3-P31-M01	03-dec-1993	CGW	59.00000	59.20000	100.000	UGL	59.0	0.0	ABHC005
MXP31012	E3-P31-M01	03-dec-1993	CGW	87.00000	87.20000	119.000	UGL	73.1	0.0	ABHC004

Analyte: NBD5 Method: SMV1 Lab: UB

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
EXP31011	E3-P31-B01	24-sep-1993	CSO	3.20000	2.90000	3.300	UGG	87.9	9.0	AEYZ003
EXP31012	E3-P31-B01	24-sep-1993	CSO	2.40000	2.30000	3.300	UGG	69.7	4.7	AEYZ004
EDP31012	E3-P31-B01	24-sep-1993	CSO	3.10000	2.90000	3.300	UGG	87.9	6.3	AEYZ005
EXP31021	E3-P31-B02	24-sep-1993	CSO	3.20000	2.90000	3.300	UGG	87.9	8.8	AEYZ006
EXP31022	E3-P31-B02	24-sep-1993	CSO	3.00000	2.80000	3.300	UGG	84.9	7.5	AEYZ007
EXP31031	E3-P31-B03	24-sep-1993	CSO	4.10000	2.90000	3.300	UGG	87.9	29.4	AEYZ008
EXP38011	E3-P38-B01	24-sep-1993	CSO	3.10000	2.90000	3.300	UGG	87.9	5.5	AEYZ009
EXP38012	E3-P38-B01	24-sep-1993	CSO	3.00000	2.70000	3.300	UGG	81.8	10.4	AEYZ010
EXP38021	E3-P38-B02	24-sep-1993	CSO	2.70000	2.60000	3.300	UGG	78.8	4.6	AEYZ011
EXP38022	E3-P38-B02	24-sep-1993	CSO	2.70000	2.60000	3.300	UGG	78.8	5.2	AEYZ012

Analyte: PHEND5 Method: SMV1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
BX360101	E3-P36-B01	05-aug-1993	CSO	1.00000	0.96800	1.670	UGG	58.0	7.3	AAMG005
BX360102	E3-P36-B01	05-aug-1993	CSO	1.10000	0.97800	1.670	UGG	58.6	8.6	AAMG006
BX360201	E3-P36-B02	05-aug-1993	CSO	0.77000	0.71800	1.670	UGG	43.0	6.8	AAMG007
BX360202	E3-P36-B02	05-aug-1993	CSO	0.97000	0.86800	1.670	UGG	52.0	10.7	AAMG008
BX370201	E3-P37-B02	06-aug-1993	CSO	0.81000	0.76600	1.670	UGG	45.9	4.9	AAMG009
BX370202	E3-P37-B02	06-aug-1993	CSO	1.10000	0.81000	1.670	UGG	48.5	25.7	AAMG010
BX370102	E3-P37-B01	09-aug-1993	CSO	1.40000	1.09000	1.670	UGG	65.3	23.3	AAMN003
BX370101	E3-P37-B01	09-aug-1993	CSO	1.20000	0.93200	1.670	UGG	55.8	22.3	AAMN004
BR3701X1	E3-P37-B02	09-aug-1993	CSO	28.00000	27.60000	100.000	UGL	28.0	0.0	AAND003
BR3801X1	E3-P38-B04	10-aug-1993	CSO	27.00000	26.70000	100.000	UGL	27.0	0.0	AAND005
BX380101	E3-P38-B04	10-aug-1993	CSO	0.61000	0.57300	1.670	UGG	34.3	6.2	AANO005
BX380102	E3-P38-B04	10-aug-1993	CSO	1.20000	0.91800	1.670	UGG	55.0	22.7	AANO006
DX3901X1	E3-P39-D01	11-aug-1993	CSE	0.80000	0.03000	1.700	UGG	8.8	81.6	AANP007
DD3901X1	E3-P39-D01	11-aug-1993	CSE	1.00000	0.06000	1.700	UGG	17.7	79.9	AANP008
DX3902X1	E3-P39-D02	11-aug-1993	CSE	0.70000	0.03200	1.700	UGG	9.4	76.2	AANP009
DX3903X1	E3-P39-D03	11-aug-1993	CSE	0.90000	0.04000	1.700	UGG	11.8	77.9	AANP010
DX3904X1	E3-P39-D04	11-aug-1993	CSE	0.50000	0.02300	1.700	UGG	6.8	77.5	AANP011
DX3906X1	E3-P39-D06	11-aug-1993	CSE	0.60000	0.02700	1.700	UGG	7.9	77.2	AANP013
BX360301	E3-P36-B03	13-aug-1993	CSO	0.79000	0.73300	1.670	UGG	43.9	7.6	AAOS010
BX360302	E3-P36-B03	13-aug-1993	CSO	0.83000	0.75700	1.670	UGG	45.3	8.7	AAOS011

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

BD370302	E3-P37-B03	16-aug-1993	CSO		0.87000	0.74200	1.670	UGG	44.4	15.1	AAOS012
BX370301	E3-P37-B03	16-aug-1993	CSO		0.76000	0.72200	1.670	UGG	43.2	4.5	AAOS013
BX370302	E3-P37-B03	16-aug-1993	CSO		0.91000	0.76100	1.670	UGG	45.6	16.2	AAOS014
SX3607X1	E3-P36-S07	24-aug-1993	CSO		0.68000	0.57400	1.670	UGG	34.4	15.2	AART011
SX3601X1	E3-P36-S01	25-aug-1993	CSO	LT	3.00000	0.33000	1.700	UGG	0.0	2.4	AASH003
SD3601X1	E3-P36-S01	25-aug-1993	CSO	LT	3.00000	0.33000	1.700	UGG	0.0	3.2	AASH004
SX3602X1	E3-P36-S02	25-aug-1993	CSO		0.25000	0.23800	1.670	UGG	14.3	6.3	AASH005
SX3603X1	E3-P36-S03	25-aug-1993	CSO		0.44000	0.42900	1.670	UGG	25.7	2.9	AASH006
SX3604X1	E3-P36-S04	25-aug-1993	CSO		0.05300	0.05000	1.670	UGG	3.0	5.2	AASH007
SX3605X1	E3-P36-S05	25-aug-1993	CSO		0.50000	0.47600	1.670	UGG	28.5	5.5	AASH008
SX3606X1	E3-P36-S06	25-aug-1993	CSO		0.30000	0.27600	1.670	UGG	16.5	7.0	AASH009
SX3608X1	E3-P36-S08	25-aug-1993	CSO		0.84000	0.70200	1.670	UGG	42.0	16.6	AASH010
SX3704X1	E3-P37-S04	25-aug-1993	CSO		0.99000	0.94400	1.670	UGG	56.5	4.9	AASI010
SX3703X1	E3-P37-S03	25-aug-1993	CSO		0.65000	0.60100	1.670	UGG	36.0	7.0	AASI009
SX3702X1	E3-P37-S02	25-aug-1993	CSO		1.00000	0.95200	1.670	UGG	57.0	7.6	AASI008
SX3701X1	E3-P37-S01	25-aug-1993	CSO		1.10000	1.04000	1.670	UGG	62.3	6.2	AASI007
SX3612X1	E3-P36-S12	25-aug-1993	CSO	LT	8.00000	0.33000	1.700	UGG	0.0	9.2	AASI006
SX3611X1	E3-P36-S11	25-aug-1993	CSO		0.50000	0.08800	1.700	UGG	25.9	6.6	AASI005
SX3609X1	E3-P36-S09	25-aug-1993	CSO		1.20000	0.97700	1.670	UGG	58.5	18.7	AASI003
SX3705X1	E3-P37-S05	25-aug-1993	CSO		0.88000	0.86000	1.670	UGG	51.5	1.8	AASP003
SX3706X1	E3-P37-S06	25-aug-1993	CSO		0.77000	0.74300	1.670	UGG	44.5	3.1	AASP004
SX3801X1	E3-P38-S01	25-aug-1993	CSO		0.73000	0.69200	1.670	UGG	41.4	4.7	AASP005
SX3802X1	E3-P38-S02	25-aug-1993	CSO		0.87000	0.85200	1.670	UGG	51.0	2.6	AASP006
SX3803X1	E3-P38-S03	25-aug-1993	CSO		0.94000	0.90400	1.670	UGG	54.1	4.0	AASP007
MXP31011	E3-P31-M01	01-sep-1993	CGW		20.00000	20.30000	100.000	UGL	20.0	0.0	AATS009
MXP36011	E3-P36-M01	01-sep-1993	CGW		30.00000	29.80000	100.000	UGL	30.0	0.0	AATS010
MXP37031	E3-P37-M03	01-sep-1993	CGW		27.00000	27.20000	100.000	UGL	27.0	0.0	AATS012
MRP37021	E3-P37-M02	02-sep-1993	CGW		38.00000	37.70000	115.000	UGL	33.0	0.0	AAUF005
MDP36021	E3-P36-M02	02-sep-1993	CGW		31.00000	30.50000	100.000	UGL	31.0	0.0	AAUF007
MXP36021	E3-P36-M02	02-sep-1993	CGW		36.00000	36.20000	112.000	UGL	32.1	0.0	AAUF006
MXP36031	E3-P36-M03	02-sep-1993	CGW		50.00000	49.90000	133.000	UGL	37.6	0.0	AAUF008
MDP37011	E3-P37-M01	02-sep-1993	CGW		22.00000	22.40000	100.000	UGL	22.0	0.0	AAUF003
MXP37021	E3-P37-M02	02-sep-1993	CGW		31.00000	30.90000	100.000	UGL	31.0	0.0	AAUF004
SX3610X1	E3-P36-S10	03-sep-1993	CSO		1.00000	0.93800	1.670	UGG	56.2	6.4	AAUV003
MXP37011	E3-P37-M01	02-sep-1993	CGW		15.00000	15.00000	100.000	UGL	15.0	0.0	AAUW003
WXP37011	E3-P37-D01	16-sep-1993	CSW		29.00000	29.00000	100.000	UGL	29.0	0.0	AAYQ008
WXP37021	E3-P37-D02	16-sep-1993	CSW		29.00000	29.40000	112.000	UGL	25.9	0.0	AAYQ012
WXP37031	E3-P37-D03	16-sep-1993	CSW		19.00000	19.40000	100.000	UGL	19.0	0.0	AAYQ009
DXP37011	E3-P37-D01	16-sep-1993	CSE		4.30000	0.88200	1.670	UGG	52.8	79.7	AAYZ003
DXP37021	E3-P37-D02	16-sep-1993	CSE		1.20000	0.85800	1.670	UGG	51.4	25.7	AAYZ005
DXP37031	E3-P37-D03	16-sep-1993	CSE		7.00000	1.08000	1.670	UGG	64.7	84.5	AAYZ004
ERP31011	E3-P31-B01	24-sep-1993	CSO		28.00000	28.30000	100.000	UGL	28.0	0.0	ABAK011
BXP37041	E3-P37-B04	01-dec-1993	CSO		1.20000	1.10000	1.670	UGG	65.9	11.2	ABFT003
BXP37042	E3-P37-B04	01-dec-1993	CSO		1.20000	1.07000	1.670	UGG	64.1	13.3	ABFT004
BXP38031	E3-P38-B03	01-dec-1993	CSO		1.10000	1.02000	1.670	UGG	61.1	10.0	ABFT005
BXP38032	E3-P38-B03	01-dec-1993	CSO		1.30000	1.04000	1.670	UGG	62.3	21.2	ABFT006
MXP36012	E3-P36-M01	01-dec-1993	CGW		31.00000	31.30000	100.000	UGL	31.0	0.0	ABFV004
MXP36022	E3-P36-M02	01-dec-1993	CGW		33.00000	32.80000	100.000	UGL	33.0	0.0	ABFV005
MXP36032	E3-P36-M03	01-dec-1993	CGW		29.00000	29.20000	100.000	UGL	29.0	0.0	ABFV006
MXP37012	E3-P37-M01	01-dec-1993	CGW		32.00000	32.40000	100.000	UGL	32.0	0.0	ABFV007
MXP37022	E3-P37-M02	01-dec-1993	CGW		30.00000	30.40000	100.000	UGL	30.0	0.0	ABFV008

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

MXP37032	E3-P37-M03	01-dec-1993	CGW	26.00000	25.80000	100.000	UGL	26.0	0.0	ABFV009
SXP36122	E3-P36-S12	02-dec-1993	CSO	0.90000	0.16000	1.700	UGG	47.1	8.0	ABGL005
MRP36012	E3-P36-M01	01-dec-1993	CGW	24.00000	23.70000	100.000	UGL	24.0	0.0	ABGM004
MRP31012	E3-P31-M01	03-dec-1993	CGW	17.00000	17.10000	100.000	UGL	17.0	0.0	ABHC006
MDP31012	E3-P31-M01	03-dec-1993	CGW	23.00000	23.20000	100.000	UGL	23.0	0.0	ABHC005
MXP31012	E3-P31-M01	03-dec-1993	CGW	28.00000	27.60000	119.000	UGL	23.5	0.0	ABHC004

Analyte: PHEND6 Method: SMV1 Lab: UB

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
EXP31011	E3-P31-B01	24-sep-1993	CSO	3.60000	3.30000	3.300	UGG	100.0	9.0	AEYZ003
EXP31012	E3-P31-B01	24-sep-1993	CSO	2.80000	2.70000	3.300	UGG	81.8	4.7	AEYZ004
EDP31012	E3-P31-B01	24-sep-1993	CSO	3.50000	3.30000	3.300	UGG	100.0	6.3	AEYZ005
EXP31021	E3-P31-B02	24-sep-1993	CSO	3.70000	3.40000	3.300	UGG	103.0	8.8	AEYZ006
EXP31022	E3-P31-B02	24-sep-1993	CSO	3.50000	3.20000	3.300	UGG	97.0	7.5	AEYZ007
EXP31031	E3-P31-B03	24-sep-1993	CSO	5.00000	3.50000	3.300	UGG	106.1	29.4	AEYZ008
EXP38011	E3-P38-B01	24-sep-1993	CSO	3.50000	3.30000	3.300	UGG	100.0	5.5	AEYZ009
EXP38012	E3-P38-B01	24-sep-1993	CSO	3.30000	3.00000	3.300	UGG	90.9	10.4	AEYZ010
EXP38021	E3-P38-B02	24-sep-1993	CSO	3.00000	2.90000	3.300	UGG	87.9	4.6	AEYZ011
EXP38022	E3-P38-B02	24-sep-1993	CSO	3.30000	3.10000	3.300	UGG	93.9	5.2	AEYZ012

Analyte: TRPD14 Method: SMV1 Lab: EL

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
BX360101	E3-P36-B01	05-aug-1993	CSO	1.20000	1.12000	1.670	UGG	67.1	7.3	AAMG005
BX360102	E3-P36-B01	05-aug-1993	CSO	1.40000	1.29000	1.670	UGG	77.3	8.6	AAMG006
BX360201	E3-P36-B02	05-aug-1993	CSO	1.20000	1.14000	1.670	UGG	68.3	6.8	AAMG007
BX360202	E3-P36-B02	05-aug-1993	CSO	1.20000	1.05000	1.670	UGG	62.9	10.7	AAMG008
BX370201	E3-P37-B02	06-aug-1993	CSO	1.40000	1.30000	1.670	UGG	77.8	4.9	AAMG009
BX370202	E3-P37-B02	06-aug-1993	CSO	1.70000	1.23000	1.670	UGG	73.7	25.7	AAMG010
BX370102	E3-P37-B01	09-aug-1993	CSO	1.60000	1.19000	1.670	UGG	71.3	23.3	AAMN003
BX370101	E3-P37-B01	09-aug-1993	CSO	1.50000	1.17000	1.670	UGG	70.1	22.3	AAMN004
BR3701X1	E3-P37-B02	09-aug-1993	CSO	88.00000	88.30000	100.000	UGL	88.0	0.0	AAND003
BR3801X1	E3-P38-B04	10-aug-1993	CSO	76.00000	75.90000	100.000	UGL	76.0	0.0	AAND005
BX380101	E3-P38-B04	10-aug-1993	CSO	1.20000	1.17000	1.670	UGG	70.1	6.2	AANO005
BX380102	E3-P38-B04	10-aug-1993	CSO	1.50000	1.19000	1.670	UGG	71.3	22.7	AANO006
DX3901X1	E3-P39-D01	11-aug-1993	CSE	4.00000	0.16000	1.700	UGG	47.1	81.6	AANP007
DD3901X1	E3-P39-D01	11-aug-1993	CSE	3.00000	0.13000	1.700	UGG	38.2	79.9	AANP008
DX3902X1	E3-P39-D02	11-aug-1993	CSE	4.00000	0.19000	1.700	UGG	55.9	76.2	AANP009
DX3903X1	E3-P39-D03	11-aug-1993	CSE	5.00000	0.21000	1.700	UGG	61.8	77.9	AANP010
DX3904X1	E3-P39-D04	11-aug-1993	CSE	4.00000	0.17000	1.670	UGG	50.9	77.5	AANP011
DX3906X1	E3-P39-D06	11-aug-1993	CSE	5.00000	0.22000	1.700	UGG	64.7	77.2	AANP013
BX360301	E3-P36-B03	13-aug-1993	CSO	1.10000	1.03000	1.670	UGG	61.7	7.6	AAOS010
BX360302	E3-P36-B03	13-aug-1993	CSO	1.10000	1.01000	1.670	UGG	60.5	8.7	AAOS011
BD370302	E3-P37-B03	16-aug-1993	CSO	1.20000	1.02000	1.670	UGG	61.1	15.1	AAOS012
BX370301	E3-P37-B03	16-aug-1993	CSO	0.99000	0.94500	1.670	UGG	56.6	4.5	AAOS013
BX370302	E3-P37-B03	16-aug-1993	CSO	1.20000	1.01000	1.670	UGG	60.5	16.2	AAOS014
SX3607X1	E3-P36-S07	24-aug-1993	CSO	0.97000	0.82600	1.670	UGG	49.5	15.2	AART011
SX3601X1	E3-P36-S01	25-aug-1993	CSO	1.00000	0.12000	1.700	UGG	70.6	2.4	AASH003
SD3601X1	E3-P36-S01	25-aug-1993	CSO	2.00000	0.19000	1.700	UGG	111.8	3.2	AASH004
SX3602X1	E3-P36-S02	25-aug-1993	CSO	1.10000	0.99800	1.670	UGG	59.8	6.3	AASH005

Recovery calculated from corrected values where moisture = 0

Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

Table F-7 Surrogate Recoveries

SX3603X1	E3-P36-S03	25-aug-1993	CSO	1.60000	1.52000	1.670	UGG	91.0	2.9	AASH006
SX3604X1	E3-P36-S04	25-aug-1993	CSO	0.88000	0.83200	1.670	UGG	49.8	5.2	AASH007
SX3605X1	E3-P36-S05	25-aug-1993	CSO	1.30000	1.23000	1.670	UGG	73.7	5.5	AASH008
SX3606X1	E3-P36-S06	25-aug-1993	CSO	1.40000	1.34000	1.670	UGG	80.2	7.0	AASH009
SX3608X1	E3-P36-S08	25-aug-1993	CSO	2.00000	1.65000	1.670	UGG	98.8	16.6	AASH010
SX3704X1	E3-P37-S04	25-aug-1993	CSO	1.30000	1.26000	1.670	UGG	75.5	4.9	AASI010
SX3703X1	E3-P37-S03	25-aug-1993	CSO	1.10000	1.05000	1.670	UGG	62.9	7.0	AASI009
SX3702X1	E3-P37-S02	25-aug-1993	CSO	1.30000	1.23000	1.670	UGG	73.7	7.6	AASI008
SX3701X1	E3-P37-S01	25-aug-1993	CSO	1.40000	1.28000	1.670	UGG	76.7	6.2	AASI007
SX3612X1	E3-P36-S12	25-aug-1993	CSO	1.00000	0.05200	1.700	UGG	76.5	9.2	AASI006
SX3611X1	E3-P36-S11	25-aug-1993	CSO	1.00000	0.28000	1.700	UGG	82.4	6.6	AASI005
SX3609X1	E3-P36-S09	25-aug-1993	CSO	1.50000	1.26000	1.670	UGG	75.5	18.7	AASI003
SX3705X1	E3-P37-S05	25-aug-1993	CSO	1.20000	1.14000	1.670	UGG	68.3	1.8	AASP003
SX3706X1	E3-P37-S06	25-aug-1993	CSO	1.30000	1.22000	1.670	UGG	73.1	3.1	AASP004
SX3801X1	E3-P38-S01	25-aug-1993	CSO	1.40000	1.33000	1.670	UGG	79.6	4.7	AASP005
SX3802X1	E3-P38-S02	25-aug-1993	CSO	1.10000	1.12000	1.670	UGG	67.1	2.6	AASP006
SX3803X1	E3-P38-S03	25-aug-1993	CSO	1.60000	1.57000	1.670	UGG	94.0	4.0	AASP007
MXP31011	E3-P31-M01	01-sep-1993	CGW	77.00000	76.80000	100.000	UGL	77.0	0.0	AATS009
MXP36011	E3-P36-M01	01-sep-1993	CGW	71.00000	71.20000	100.000	UGL	71.0	0.0	AATS010
MXP37031	E3-P37-M03	01-sep-1993	CGW	71.00000	70.70000	100.000	UGL	71.0	0.0	AATS012
MRP37021	E3-P37-M02	02-sep-1993	CGW	84.00000	83.80000	115.000	UGL	73.0	0.0	AAUF005
MDP36021	E3-P36-M02	02-sep-1993	CGW	78.00000	77.60000	100.000	UGL	78.0	0.0	AAUF007
MXP36021	E3-P36-M02	02-sep-1993	CGW	94.00000	94.10000	112.000	UGL	83.9	0.0	AAUF006
MXP36031	E3-P36-M03	02-sep-1993	CGW	98.00000	97.60000	133.000	UGL	73.7	0.0	AAUF008
MDP37011	E3-P37-M01	02-sep-1993	CGW	70.00000	70.10000	100.000	UGL	70.0	0.0	AAUF003
MXP37021	E3-P37-M02	02-sep-1993	CGW	80.00000	79.70000	100.000	UGL	80.0	0.0	AAUF004
SX3610X1	E3-P36-S10	03-sep-1993	CSO	1.20000	1.13000	1.670	UGG	67.7	6.4	AAUV003
MXP37011	E3-P37-M01	02-sep-1993	CGW	84.00000	84.40000	100.000	UGL	84.0	0.0	AAUW003
WXP37011	E3-P37-D01	16-sep-1993	CSW	52.00000	52.00000	100.000	UGL	52.0	0.0	AAYQ008
WXP37021	E3-P37-D02	16-sep-1993	CSW	99.00000	98.50000	112.000	UGL	88.4	0.0	AAYQ012
WXP37031	E3-P37-D03	16-sep-1993	CSW	110.00000	106.00000	100.000	UGL	110.0	0.0	AAYQ009
DXP37011	E3-P37-D01	16-sep-1993	CSE	4.60000	0.93200	1.670	UGG	55.8	79.7	AAYZ003
DXP37021	E3-P37-D02	16-sep-1993	CSE	1.60000	1.20000	1.670	UGG	71.9	25.7	AAYZ005
DXP37031	E3-P37-D03	16-sep-1993	CSE	7.90000	1.22000	1.670	UGG	73.1	84.5	AAYZ004
ERP31011	E3-P31-B01	24-sep-1993	CSO	73.00000	72.50000	100.000	UGL	73.0	0.0	ABAK011
BXP37041	E3-P37-B04	01-dec-1993	CSO	1.30000	1.13000	1.670	UGG	67.7	11.2	ABFT003
BXP37042	E3-P37-B04	01-dec-1993	CSO	1.20000	1.07000	1.670	UGG	64.1	13.3	ABFT004
BXP38031	E3-P38-B03	01-dec-1993	CSO	1.20000	1.04000	1.670	UGG	62.3	10.0	ABFT005
BXP38032	E3-P38-B03	01-dec-1993	CSO	1.40000	1.11000	1.670	UGG	66.5	21.2	ABFT006
MXP36012	E3-P36-M01	01-dec-1993	CGW	100.00000	103.00000	100.000	UGL	100.0	0.0	ABFV004
MXP36022	E3-P36-M02	01-dec-1993	CGW	100.00000	102.00000	100.000	UGL	100.0	0.0	ABFV005
MXP36032	E3-P36-M03	01-dec-1993	CGW	110.00000	111.00000	100.000	UGL	110.0	0.0	ABFV006
MXP37012	E3-P37-M01	01-dec-1993	CGW	77.00000	77.00000	100.000	UGL	77.0	0.0	ABFV007
MXP37022	E3-P37-M02	01-dec-1993	CGW	99.00000	98.80000	100.000	UGL	99.0	0.0	ABFV008
MXP37032	E3-P37-M03	01-dec-1993	CGW	98.00000	98.00000	100.000	UGL	98.0	0.0	ABFV009
SXP36122	E3-P36-S12	02-dec-1993	CSO	1.00000	0.23000	1.700	UGG	67.7	8.0	ABGL005
MRP36012	E3-P36-M01	01-dec-1993	CGW	82.00000	82.00000	100.000	UGL	82.0	0.0	ABGM004
MRP31012	E3-P31-M01	03-dec-1993	CGW	93.00000	92.80000	100.000	UGL	93.0	0.0	ABHC006
MDP31012	E3-P31-M01	03-dec-1993	CGW	97.00000	96.60000	100.000	UGL	97.0	0.0	ABHC005
MXP31012	E3-P31-M01	03-dec-1993	CGW	110.00000	112.00000	119.000	UGL	92.4	0.0	ABHC004

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

Table F-7 Surrogate Recoveries

Analyte: TRPD14 Method: SMV1 Lab: UB

Field Sample no	Site ID	Sample Date	Media Type	Corrected Value	Uncorrected Value	Spike Amount	Units	% Rec.	% H20	Lot/ Sample
EXP31011	E3-P31-B01	24-sep-1993	CSO	3.50000	3.20000	3.300	UGG	97.0	9.0	AEYZ003
EXP31012	E3-P31-B01	24-sep-1993	CSO	2.80000	2.70000	3.300	UGG	81.8	4.7	AEYZ004
EDP31012	E3-P31-B01	24-sep-1993	CSO	3.40000	3.20000	3.300	UGG	97.0	6.3	AEYZ005
EXP31021	E3-P31-B02	24-sep-1993	CSO	3.60000	3.30000	3.300	UGG	100.0	8.8	AEYZ006
EXP31022	E3-P31-B02	24-sep-1993	CSO	3.20000	3.00000	3.300	UGG	90.9	7.5	AEYZ007
EXP31031	E3-P31-B03	24-sep-1993	CSO	4.40000	3.10000	3.300	UGG	93.9	29.4	AEYZ008
EXP38011	E3-P38-B01	24-sep-1993	CSO	3.40000	3.20000	3.300	UGG	97.0	5.5	AEYZ009
EXP38012	E3-P38-B01	24-sep-1993	CSO	3.20000	2.90000	3.300	UGG	87.9	10.4	AEYZ010
EXP38021	E3-P38-B02	24-sep-1993	CSO	3.40000	3.20000	3.300	UGG	97.0	4.6	AEYZ011
EXP38022	E3-P38-B02	24-sep-1993	CSO	3.40000	3.20000	3.300	UGG	97.0	5.2	AEYZ012

Recovery calculated from corrected values where moisture = 0
Recovery calculated from uncorrected values (and dilution factors) where moisture > 0

Table F-8

Percent Solids in Sediment

Site ID	Field Sample Number	Percent Solids	Sample Date
E3-BCK-D01	DXBCK011	77.7	09/15/93
E3-BCK-D02	DXBCK021	74.0	09/22/93
E3-BCK-D02	DDBCK021	73.8	09/22/93
E3-BCK-D03	DXBCK031	79.2	09/17/93
E3-BCK-D04	DXBCK041	84.7	09/17/93
E3-BCK-D05	DXBCK051	99.3	09/22/93
E3-BCK-D08	DXBCK081	80.4	09/21/93
E3-P11-D01	DX1101X1	66.8	08/03/93
E3-P11-D02	DX1102X1	47.9	08/03/93
E3-P11-D03	DXP11031	73.2	09/15/93
E3-P11-D04	DXP11042	19.3	12/02/93
E3-P11-D04	DX1104X2	48.9	04/26/94
E3-P13-D01	DX1301X1	14.5	08/02/93
E3-P13-D01	DD1301X1	47.9	08/02/93
E3-P13-D01	DXP13012	17.4	12/01/93
E3-P13-D02	DX1302X1	96.5	08/02/93
E3-P13-D02	DXP13022	91.2	12/01/93
E3-P13-D03	DX1303X1	86.8	08/03/93
E3-P13-D03	DXP13032	62.0	12/01/93
E3-P13-D04	DX1304X1	64.1	08/03/93
E3-P13-D04	DXP13042	71.9	12/01/93
E3-P13-D05	DX1305X1	71.4	08/03/93
E3-P13-D05	DXP13052	74.5	12/01/93
E3-P37-D01	DXP37011	20.3	09/16/93
E3-P37-D02	DXP37021	77.7	09/16/93
E3-P37-D03	DXP37031	34.5	09/23/93

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APPENDIX G

AQUIFER HYDRAULIC CHARACTERIZATION (SLUG TESTING)

APPENDIX G

AQUIFER HYDRAULIC CHARACTERIZATION (SLUG TESTING)

This is a technical report presenting the results of hydraulic conductivity tests conducted on Ecology and Environment, Inc. wells at the Sudbury Annex and a brief interpretation of the results. The text in Volumes II and III provide further interpretation and manipulation of the data to compare with results of previous tests and help assess aquifer characteristics by watershed.

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SLUG TEST REPORT

G.1 INTRODUCTION

In 1993, the United States Army Environmental Center (USAEC) retained Ecology & Environment, Inc. (E & E) to conduct Remedial Investigations (RIs) and Site Investigations (SIs) at the Sudbury Annex in Sudbury, Massachusetts.

As part of these activities at the Annex, E & E conducted hydraulic conductivity tests (slug testing) in wells installed during the summer of 1993. This report documents the results of the slug tests conducted for monitoring wells at various areas of concern at this site. Section G.2 describes the objectives of the tests, while Sections G.3 and G.4 detail the field methodology and data reduction and interpretation methodologies. The results of the tests are summarized in Section G.5, and conclusions and recommendations are presented in Section G.6. The raw data that resulted from the slug test are reproduced in Appendix A and Appendix B.

G.2 OBJECTIVES

E & E conducted slug tests in the new wells installed during the 1993 Field Investigation Activities at the Annex. The objectives of these tests were as follows:

- To determine the hydraulic conductivity of the water-bearing geological formations near and around the installed monitoring wells. The hydraulic conductivity of a formation will indicate the capacity for water conduction in each geological unit that is tested.
- To characterize and calculate the transmissivity of the water-bearing formations near and/or around the monitoring well screens. The transmissivity of an aquifer is the capacity of the aquifer to transmit water through a unit cross-sectional area of the formation.
- To help determine the rate of groundwater flow in tested areas.
- To help evaluate mass loading of the contaminant from the groundwater to the surface water bodies (if needed).
- To help estimate the transport rate of contaminants within the groundwater and from the groundwater to surface bodies, and adjacent streams at the sites (if needed).

G.3 FIELD METHODOLOGY

E & E conducted slug tests at the Annex using the Hermit 2000 electronic data logger and 10 and/or 20 pounds per square inch (PSI) transducers. The field methodology used for conducting the slug test at the Annex is described below.

Slugs of various sizes (2 feet and 5 feet in length with 1.25-inch, 1.50 inch, and 3.00-inch outside diameters (OD)) were made from new PVC casing. The PVC slugs were filled with clean sand (commercial sand used for the well construction) and sealed at both ends.

E & E conducted both rising and falling head slug tests at each well. Both tests involved measurement of changes in water displacement caused by introduction of various slug sizes into each well. As the slug was lowered rapidly into a monitoring well, the water level rose in response. The water level then decreased as the well returned to equilibrium with the outside water level. The changes in the water level, with respect to time, were measured and recorded by the transducer and data logger. After the well had returned to its initial condition, the slug was rapidly removed causing an immediate drop in the water level. Measurements were again recorded as the water level returned to its original condition. E & E performed this procedure for each monitoring well tested during the 1993 slug testing activities at Fort Devens site.

OVA readings were taken before starting each test to determine if volatile organics from the well opening were possible health hazards. The total depth and depth to the water table were measured and recorded, and other data, pertinent to the tested well, were recorded on the slug test data sheet. Total depth and depth-to-water were measured using a weighted tape and an audible; electronic; water-level meter. These measurements were used to determine the length of the water column and to determine the appropriate slug length. A minimum of 3 to 4 feet of water was needed to run the slug test with a 2-foot slug.

Where possible and appropriate two or more monitoring wells were tested simultaneously. However, due to a locally fast well recovery, and distances between the wells (greater than 250 feet) most of the wells were tested individually.

Originally, a total of 27 newly installed monitoring wells were to be tested at the Annex. However, only 26 wells could be tested because well E3-A6-MO1 did not have sufficient water for testing. Table G-1 summarizes the slug test data and provides information on those monitoring wells tested.

Before running any tests, the scale factor, linearity, offset, and other transducer and test parameters were set on the data logger in accordance with the specifications provided by the data logger and transducers operations manual and transducer, to test single wells. If additional wells were tested simultaneously, E & E used subsequent input (e.g., 2, 3 ....) and set corresponding parameters as Input 2.3. Once all the parameters are set, they do not need

Table G-1

SLUG TEST DATA
SUDBURY, MASSACHUSETTS SITE

Well Number Format	Total Depth (TOC)[2]	Water Level (TOC)[2]	Slug Size Used (L/D)[1]	PVC Casing Diameter	Screen Interval	Top of Sandpac k
E3-P11-MO1	18.21	9.44	2 feet 3 inches	4.00	6-16	4.0
E3-P13-MO1	20.46	14.51	5 feet 3 inches	4.00	9-19	7.0
E3-P13-MO2	19.91	5.73	2 feet 3 inches	4.00	8-18	6.0
E3-P13-M03	18.66	7.67	5 feet 3 inches	4.00	8-18	6.0
E3-P13-MO4	20.16	8.73	5 feet 3 inches	4.00	8.6-18.6	6.6
E3-P36-MO1	19.50	17.01	2 feet 3 inches	4.00	8-18	6.0
E3-P36-MO2	20.80	15.60	6 feet 1.25 inches	4.00	8-18	6.0
E3-P36-MO3	21.18	16.68	2 feet 3 inches	4.00	9-19	7.0
E3-P37-MO1	21.14	13.95	6 feet 2.50 inches	4.00	9-19	7.5
E3-P37-MO2	20.85	16.32	2 feet 3 inches	4.00	9-19	7.5
E3-P37-MO3	21.82	16.93	2 feet 3 inches	4.00	10-20	8.0

[1]L = Length of Slug (in feet); D = Outside Diameter of slug (in inches)
[2]TOC = Top of Casing

to be reset between tests. After the head reference is set, the data logger is ready to record data.

E & E rinsed all tapes, transducers, slugs and meters with water from the USAEC approved source before and after placement and at the time of slug removal from the monitoring well. In shallow wells, the transducer probe(s) were lowered to the bottom of the monitoring well and then raised a minimum of several inches to avoid interferences from potential sediment. In deep wells the transducer probe was lowered 2 to 10 feet below the bottom of the slug. Before testing each well, E & E carefully measured the rope connected to the slug to a length that allowed the slug to be completely submerged while allowing enough room for the transducer probe below the slug.

At each well location, the test number was entered into the data logger and recorded on the slug test data sheet. The slug was then lowered into the well and was held above the water level. The data logger reference value was then set at zero (since E & E was interested only in changes in water depth). The water level, as read by the transducer, was checked to ensure that the water level was stable and the drawdown was zero. If for some reason the drawdown indicated some change, the reference was reset at zero. The slug was then lowered quickly but steadily into the water at the same time as the test was started on the data logger. The data logger then recorded the falling head data until the static level was reached or the water fell to within 10 percent of the initial elevation. The recovery time for the majority of the tested wells at Sudbury ranged from less than a minute to 1 hour or more.

After recording the head, drawdown, and time, E & E performed the rising head test. To start the rising head test, the slug was removed and simultaneously the data logger began recording. The rising head test was run as a step test and the data recorded as Step 1 rather than Step 0. This produced a separate data file for each falling and rising head test with both starting times as zero. After a minimum of 90 percent recovery to the initial water level, E & E recorded the drawdown and time and stopped the test.

G.4 DATA REDUCTION AND INTERPRETATION

E & E electronically transferred data collected in the field to a microcomputer for data reduction and interpretation. Because the data logger can only hold up to 10 tests, the recorded data was downloaded on a daily basis to the microcomputer. The data were stored on the hard drive and a backup copy was made on a diskette. After the data were downloaded, the Hermit was reset so that the data logger could be made available for further slug testing.

The following steps were used in data reduction:

- Checked data transferred from the Hermit disk and checked for corrections and completeness;

- Generated a second type of file which included only time and drawdown, to be used by the slug interpretation package (SLUGIX);

- Developed an in-house computer program to generate a printout of raw Hermit data files (Appendix G-A); and

- Imported Hermit data into the SLUGIX file for interpretation.

The data were interpreted using SLUGIX, a program written by Interpex in Denver, Colorado, designed to match the data to theoretical type curves to determine the hydraulic parameters of the tested media. Slug test data for unconfined aquifers was analyzed using the Bouwer and Rice (1976) method. Both rising head and falling head data were interpreted for each well. For wells with top of screen and/or sand pack partially above the water table, only rising head data were considered, unless the rising head data were not usable. In these cases, the falling head data were used.

For wells with screen and sand pack fully submerged into the water, the rising head and falling head data were averaged and the average was used for further statistical analysis of hydraulic parameters of the aquifer beneath the site. This was the procedure for monitoring wells at the Annex because none of the well logs indicated confining condition. Interpreted graphics files were used and were saved as input files after a good match was obtained between the observed data and average regression line. The graphics files were then used to plot the slug test, two-dimensional graphics (Appendices G-A and G-B).

The hydraulic conductivity and transmissivity values derived from the curve matching were then reviewed for consistency with the hydraulic conductivity of the type of formation encountered at the site (e.g., glacial till, silty sand, fine, or medium grain sands) as derived from previous investigative records. Wells constructed in formations with low hydraulic conductivity (e.g., in silty or clayey formations) or in very highly permeable formations (e.g., coarse grained sand) indicated very slow or very fast stabilization time, respectively. The resulting slug test data from these extreme types of lithological units were, often, difficult to interpret (e.g., bad data; Table G-2). In general, monitoring wells constructed in formation with hydraulic conductivity in the range of 1 to 10^{-6} feet per minute are most suitable for slug testing.

G.5 SLUG TEST RESULTS

The results of the slug tests performed on newly installed monitoring wells during the 1993 field investigation at the Annex are summarized on Table G-2.

The calculated hydraulic conductivity values from the slug test results range from 2.25×10^{-4} feet per minute, which is the minimum value at monitoring well E3-P3-MO2, to 3.3×10^{-2} feet per minute, which is the maximum value at monitoring well E3-A2-MO1.

Table G-2

SLUG TEST DATA INTERPRETATION

Well No.	Type of Test	Hydraulic Conductivity (Feet Per Minute)	Transmissivity (Feet Per Minute)	Remarks
Northern Area of the Annex:				
E3-P11-MO1	R	0.004169	0.03656	
E3-P13-MO1	R	0.002455	0.01461	
E3-P13-MO2	R+F	0.0102(1)	0.14415(1)	
E3-P13-MO3	R	0.002889	0.03175	
E3-P13-MO4	R	0.005143	0.05878	
AVERAGE(2)		0.00934	0.08434	
Southern Area of the Annex:				
E3-P36-MO1	R	0.00347	0.00865	
E3-P36-MO2	R	0.0005793	0.003012	
E3-P36-MO3	R	0.00667	0.03001	
E3-P37-MO1	R	0.008096	0.05821	
E3-P37-MO2	R	0.000793	0.00359	
E3-P37-MO3	R	0.01656	0.0810	
AVERAGE		0.00583	0.03031	
Eastern Area of the Annex:				
AVERAGE		0.00049	0.00780	
Western Area of the Annex:				
AVERAGE		0.00622	0.20979	
STATISTICAL ANALYSIS FOR ALL WELLS				
Maximum		0.033 at E3-A2-MO1	0.8376 at E3-P58-MO1	
Minimum		0.000225 at E3-P3-MO2	0.00115 at E3-PO3-MO2	
Average		0.00678	0.08509	Average and S Based on 26 data.
Standard Deviation(s)	0.00831	0.16461		Average and S Based on 26 data.

(1) Average value between rising head and falling head data.
R = Rising Head
F = Falling Head

(2) AVERAGE represents the average for the Northern Area of the Annex based on the results from all wells located in the region. Eleven wells are located in the Northern Area and seven wells are in the Southern Area.

Source: Ecology and Environment, Inc., 1994.

The calculated average hydraulic conductivity from all slug testing completed in September 1993 at the Annex is 0.00678 feet per minute, with a standard deviation of 0.00831 feet per minute. The tested wells at Annex sites were grouped into four geographical areas by sites though only two areas are considered this report. Calculated average hydraulic conductivity and transmissivity values for the sites during the 1993 field investigation at the Sudbury Annex are as follows:

Site Name	Site No.	Average Hydraulic Conductivity (in feet per minute)	Average Transmissivity (in square feet per minute)
Northern Area of the Annex	P11 P13	0.00934	0.08434
Southern Area of the Annex	P36 P37	0.00583	0.03031

G.6 CONCLUSIONS

E & E slug tested a total of 26 out of 27 monitoring wells initially planned foresting at the Annex. Well information is provided in Table G-1, and the calculated hydraulic parameters of the aquifer beneath the sites are shown in Table G-2. The followings are principal findings and conclusions from these tests.

- In general, the results of the slug tests confirm the findings of boring logs and/or monitoring well installation at the Annex (e.g., the lowest hydraulic parameters were identified in well E3-P3-MO2 installed in low conductivity formations such as silty and clayey sand.

- The water-bearing formation of the northern area of the Annex are characterized by an average hydraulic conductivity of 0.00934 feet per minute and by an average transmissivity of 0.08434 feet^2 per minute. The aquifer in this area may be composed of medium to slightly coarse grained sand with locally silty and fine grained sand (e.g., near E3-P26-MO3 and E3-P57-MO1).

- The aquifer beneath the southern area of the Annex is characterized by an average hydraulic conductivity of 0.00583 feet per minute and by an average transmissivity of 0.03031 feet^2 per minute, which are indicative of similar formations as the area described above (northern area) with slightly finer-grained sand.

- The water bearing formations in the eastern area of the Annex are characterized by the lowest hydraulic parameters. This indicates that the water bearing formation in this area is mainly silty and clayey sand. The average hydraulic conductivity of the aquifer beneath this

area was 0.00049 feet per minute, with an average transmissivity of 0.0078 feet^2 per minute.

- The water bearing formation in the western area of the Annex is characterized by an average hydraulic conductivity of 0.00622 feet per minute, and by an average transmissivity of 0.20979 feet^2 per minute. The maximum transmissivity value was identified in this area at well E3-P58-MO1.

APPENDIX G-A
(SLUG TEST)

FALLING HEAD DATA AND INTERPRETED GRAPHS
FORT DEVENS, MASSACHUSETTS SITE

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P11-M01

Reference	0.000
SG	1.000
Linearity	0.004
Time	20:06
Logger Test	1

Scale Factor	10.051
Offset	-0.010
Delay mSEC	50.000
Date	09/23 /93
INPUT 1 Level (F)	

Step 0 09/23 08:22:31

Elapsed Time	INPUT 1
0.0000	0.025
0.0083	0.028
0.0166	0.044
0.0250	0.028
0.0333	1.815
0.0416	0.968
0.0500	4.053
0.0583	4.892
0.0666	5.158
0.0750	5.314
0.0833	5.403
0.0916	5.419
0.1000	5.352
0.1083	4.180
0.1166	2.326
0.1250	4.009
0.1333	3.212
0.1416	3.482
0.1500	3.444
0.1583	3.412
0.1666	3.428
0.1750	3.422
0.1833	3.415
0.1916	3.412
0.2000	3.409
0.2083	3.406
0.2166	3.403
0.2250	3.399
0.2333	3.393
0.2416	3.393
0.2500	3.387
0.2583	3.384
0.2666	3.380
0.2750	3.377
0.2833	3.374
0.2916	3.368
0.3000	3.365
0.3083	3.361
0.3166	3.358

Elapsed Time	INPUT 1
0.3250	3.355
0.3333	3.352
0.3500	3.345
0.3666	3.339
0.3833	3.330
0.4000	3.323
0.4166	3.317
0.4333	3.311
0.4500	3.304
0.4666	3.298
0.4833	3.292
0.5000	3.285
0.5166	3.279
0.5333	3.272
0.5500	3.266
0.5666	3.263
0.5833	3.257
0.6000	3.250
0.6166	3.244
0.6333	3.238
0.6500	3.231
0.6666	3.225
0.6833	3.222
0.7000	3.215
0.7166	3.209
0.7333	3.206
0.7500	3.199
0.7666	3.193
0.7833	3.187
0.8000	3.184
0.8166	3.177
0.8333	3.171
0.8500	3.168
0.8666	3.161
0.8833	3.158
0.9000	3.152
0.9166	3.145
0.9333	3.142
0.9500	3.136

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P11-M01

Reference	0.000
SG	1.000
Linearity	0.004
Time	20:06
Logger Test	1

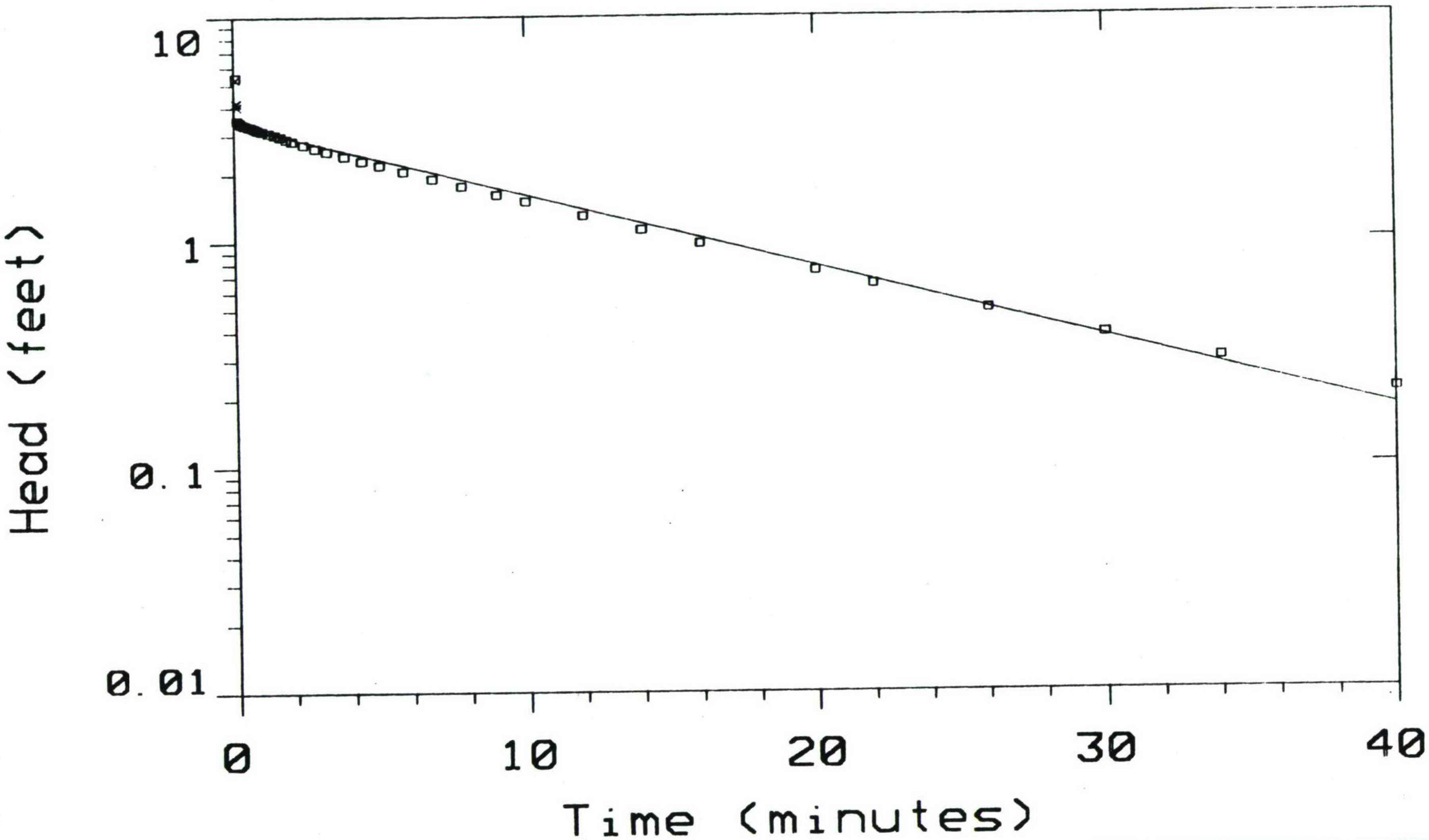
Scale Factor	10.051
Offset	-0.010
Delay mSEC	50.000
Date	09/23 /93

INPUT 1 Level (F)

Step 0 09/23 08:22:31

Elapsed Time	INPUT 1
0.9666	3.130
0.9833	3.126
1.0000	3.120
1.2000	3.063
1.4000	3.009
1.6000	2.949
1.8000	2.888
2.0000	2.831
2.2000	2.777
2.4000	2.723
2.6000	2.676
2.8000	2.628
3.0000	2.580
3.2000	2.536
3.4000	2.495
3.6000	2.450
3.8000	2.412
4.0000	2.371
4.2000	2.333
4.4000	2.295
4.6000	2.260
4.8000	2.222
5.0000	2.187
5.2000	2.155
5.4000	2.120
5.6000	2.088
5.8000	2.057
6.0000	2.025
6.2000	1.993
6.4000	1.961
6.6000	1.933
6.8000	1.904
7.0000	1.876
7.2000	1.847
7.4000	1.818
7.6000	1.793
7.8000	1.768
8.0000	1.739
8.2000	1.714

Elapsed Time	INPUT 1
8.4000	1.688
8.6000	1.666
8.8000	1.641
9.0000	1.615
9.2000	1.593
9.4000	1.571
9.6000	1.545
9.8000	1.526
10.0000	1.504
12.0000	1.298
14.0000	1.123
16.0000	0.974
18.0000	0.847
20.0000	0.739
22.0000	0.644
24.0000	0.565
26.0000	0.495
28.0000	0.431
30.0000	0.380
32.0000	0.336
34.0000	0.298
36.0000	0.266
38.0000	0.238
40.0000	0.212
42.0000	0.190
44.0000	0.171
46.0000	0.152
48.0000	0.133
50.0000	0.120
52.0000	0.107
54.0000	0.095



MODEL TYPE: BOUWER and RICE	for: USAEC	Well Slug Test Data
CONDUCTIVITY: .0003599 ft/min	by: Ecology & Environment	Well: E3-P11-M01
TRANSMISSIVITY: .003156 sq. ft/min	WELL DATA: Units: ft	SUDBURY, MA
INITIAL HEAD: 5.314 ft	AQUIFER: Endless	SUDBURY
Data Set: P11M1S0	THICKNESS: 8.770	
Date: 9-23-93	SCREEN: top: 8.000 base: 18.00	
	DIAMETER: casing: .3400 intake: .3400	
	DEPTH: Water Table: 9.440 TD: 18.21	

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P13-M01

Reference	0.000
SG	1.000
Linearity	-0.000
Time	19:41
Logger Test	7

Scale Factor	9.990
Offset	-0.009
Delay mSEC	50.000
Date	09/22 /93
INPUT 1	Level (F)

Step 0 09/22 16:13:25

Elapsed Time	INPUT 1
0.0000	0.003
0.0083	0.003
0.0166	0.003
0.0250	0.003
0.0333	0.006
0.0416	0.006
0.0500	0.012
0.0583	0.015
0.0666	1.592
0.0750	1.640
0.0833	1.482
0.0916	1.308
0.1000	0.627
0.1083	0.044
0.1166	0.589
0.1250	0.428
0.1333	0.403
0.1416	0.406
0.1500	0.400
0.1583	0.397
0.1666	0.394
0.1750	0.391
0.1833	0.391
0.1916	0.387
0.2000	0.387
0.2083	0.384
0.2166	0.381
0.2250	0.381
0.2333	0.381
0.2416	0.378
0.2500	0.378
0.2583	0.375
0.2666	0.375
0.2750	0.372
0.2833	0.372
0.2916	0.369
0.3000	0.369
0.3083	0.365
0.3166	0.365

Elapsed Time	INPUT 1
0.3250	0.365
0.3333	0.362
0.3500	0.359
0.3666	0.356
0.3833	0.356
0.4000	0.353
0.4166	0.350
0.4333	0.346
0.4500	0.343
0.4666	0.343
0.4833	0.340
0.5000	0.337
0.5166	0.337
0.5333	0.334
0.5500	0.334
0.5666	0.331
0.5833	0.328
0.6000	0.328
0.6166	0.324
0.6333	0.324
0.6500	0.321
0.6666	0.321
0.6833	0.318
0.7000	0.318
0.7166	0.315
0.7333	0.315
0.7500	0.315
0.7666	0.312
0.7833	0.309
0.8000	0.309
0.8166	0.305
0.8333	0.305
0.8500	0.302
0.8666	0.302
0.8833	0.302
0.9000	0.299
0.9166	0.299
0.9333	0.299
0.9500	0.296

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P13-M01

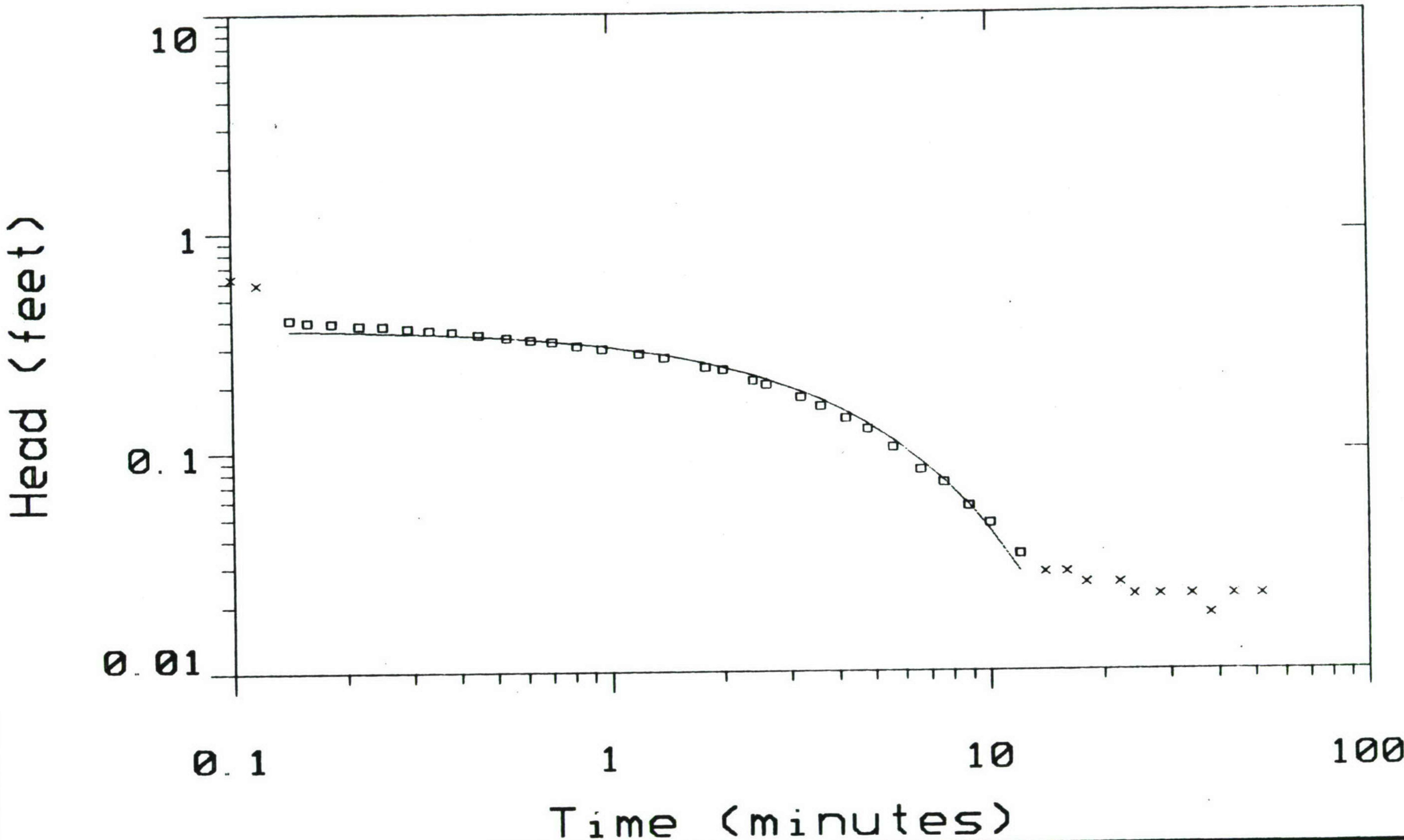
Reference	0.000
SG	1.000
Linearity	-0.000
Time	19:41
Logger Test	7

Scale Factor	9.990
Offset	-0.009
Delay mSEC	50.000
Date	09/22 /93
INPUT 1 Level	(F)

Step 0 09/22 16:13:25

Elapsed Time	INPUT 1
0.9666	0.296
0.9833	0.293
1.0000	0.293
1.2000	0.280
1.4000	0.268
1.6000	0.255
1.8000	0.242
2.0000	0.236
2.2000	0.220
2.4000	0.211
2.6000	0.201
2.8000	0.195
3.0000	0.186
3.2000	0.176
3.4000	0.173
3.6000	0.160
3.8000	0.154
4.0000	0.148
4.2000	0.141
4.4000	0.135
4.6000	0.129
4.8000	0.126
5.0000	0.119
5.2000	0.113
5.4000	0.110
5.6000	0.104
5.8000	0.100
6.0000	0.097
6.2000	0.094
6.4000	0.088
6.6000	0.082
6.8000	0.085
7.0000	0.078
7.2000	0.078
7.4000	0.072
7.6000	0.072
7.8000	0.069
8.0000	0.047
8.2000	0.094

Elapsed Time	INPUT 1
8.4000	0.072
8.6000	0.056
8.8000	0.056
9.0000	0.047
9.2000	0.050
9.4000	0.050
9.6000	0.050
9.8000	0.047
10.0000	0.047
12.0000	0.034
14.0000	0.028
16.0000	0.028
18.0000	0.025
20.0000	0.025
22.0000	0.025
24.0000	0.022
26.0000	0.022
28.0000	0.022
30.0000	0.022
32.0000	0.025
34.0000	0.022
36.0000	0.022
38.0000	0.018
40.0000	0.022
42.0000	0.022
44.0000	0.022
46.0000	0.022
48.0000	0.022
50.0000	0.022
52.0000	0.022



MODEL TYPE: BOUWER and RICE

CONDUCTIVITY: .001275 ft/min

TRANSMISSIVITY: .007588 sq. ft/min

INITIAL HEAD: 1.640 ft

Data Set: P13MIS0 | Date: 09-22-93

for: USAEC

by: Ecology & Environment

WELL DATA: Units: ft

AQUIFER: Endless

THICKNESS: 5.950

SCREEN: top 10.00 base 20.00

DIAMETER: casing: .3400 intake .3400

DEPTH: Water Table: 14.51 TD: 20.46

Well Slug Test Data

Well: E3-P13-M01

SUDBURY, MA

SUDBURY

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P13-M02

Reference	0.000
SG	1.000
Linearity	0.004
Time	19:59
Logger Test	3

Scale Factor	10.051
Offset	-0.010
Delay mSEC	50.000
Date	09/23 /93
INPUT 1	Level (F)

Step 0 09/23 11:05:24

Elapsed Time	INPUT 1
0.0000	1.771
0.0083	2.111
0.0166	2.571
0.0250	2.952
0.0333	3.190
0.0416	2.857
0.0500	3.549
0.0583	2.740
0.0666	2.587
0.0750	1.809
0.0833	2.070
0.0916	1.012
0.1000	0.755
0.1083	1.263
0.1166	1.279
0.1250	1.149
0.1333	1.111
0.1416	1.069
0.1500	1.025
0.1583	0.987
0.1666	0.952
0.1750	0.920
0.1833	0.885
0.1916	0.854
0.2000	0.825
0.2083	0.796
0.2166	0.768
0.2250	0.746
0.2333	0.720
0.2416	0.698
0.2500	0.682
0.2583	0.660
0.2666	0.641
0.2750	0.622
0.2833	0.609
0.2916	0.593
0.3000	0.577
0.3083	0.561
0.3166	0.546

Elapsed Time	INPUT 1
0.3250	0.536
0.3333	0.520
0.3500	0.498
0.3666	0.476
0.3833	0.457
0.4000	0.438
0.4166	0.422
0.4333	0.400
0.4500	0.387
0.4666	0.371
0.4833	0.355
0.5000	0.342
0.5166	0.330
0.5333	0.320
0.5500	0.307
0.5666	0.298
0.5833	0.292
0.6000	0.279
0.6166	0.273
0.6333	0.266
0.6500	0.260
0.6666	0.250
0.6833	0.244
0.7000	0.238
0.7166	0.234
0.7333	0.228
0.7500	0.219
0.7666	0.215
0.7833	0.212
0.8000	0.209
0.8166	0.206
0.8333	0.200
0.8500	0.196
0.8666	0.190
0.8833	0.187
0.9000	0.184
0.9166	0.180
0.9333	0.177
0.9500	0.174

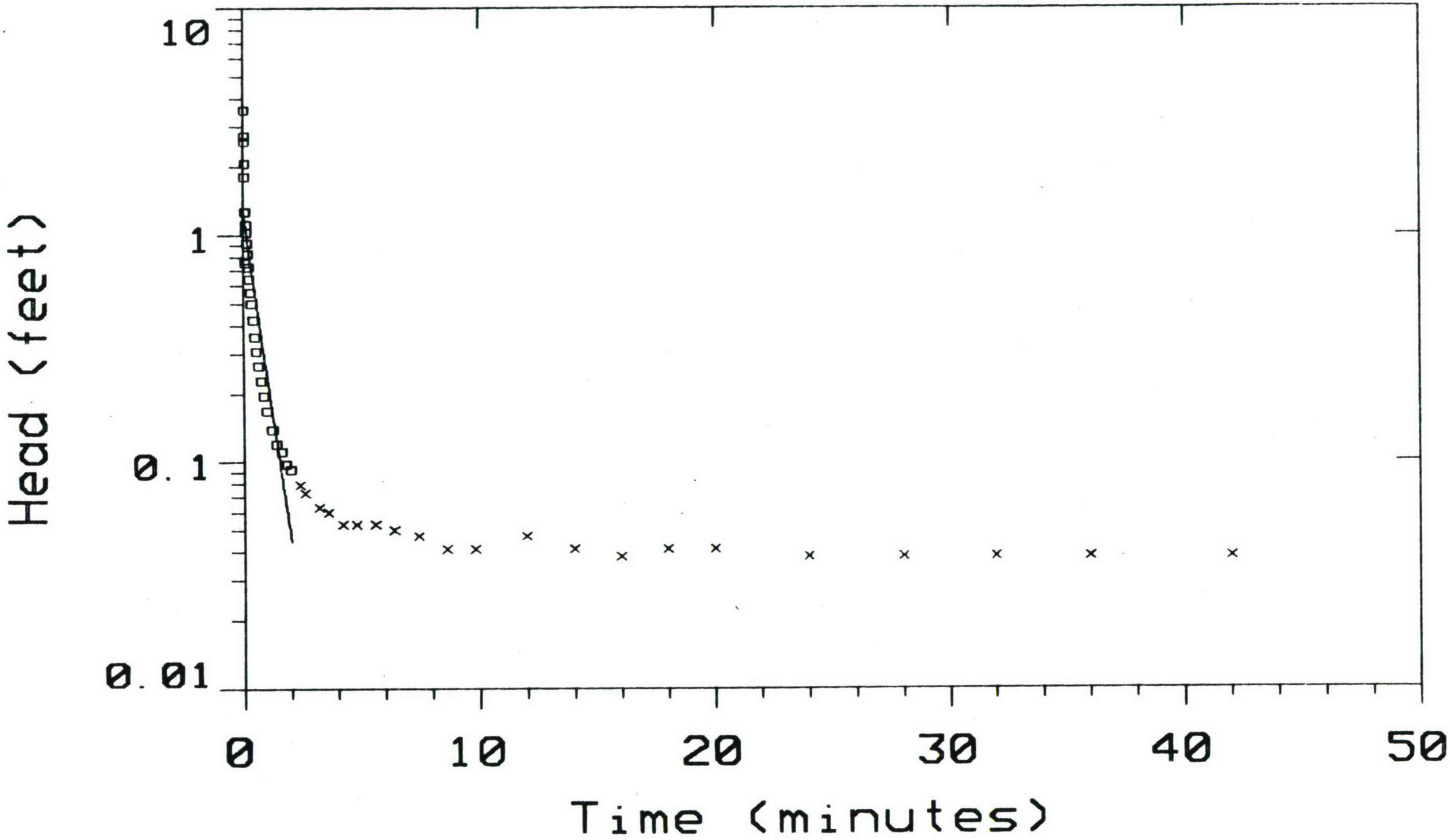
ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P13-M02

Reference	0.000	Scale Factor	10.051
SG	1.000	Offset	-0.010
Linearity	0.004	Delay mSEC	50.000
Time	19:59	Date	09/23 /93
Logger Test	3	INPUT 1 Level (F)	

Step 0 09/23 11:05:24

Elapsed Time	INPUT 1
0.9666	0.171
0.9833	0.168
1.0000	0.165
1.2000	0.139
1.4000	0.120
1.6000	0.111
1.8000	0.098
2.0000	0.092
2.2000	0.085
2.4000	0.079
2.6000	0.073
2.8000	0.069
3.0000	0.066
3.2000	0.063
3.4000	0.060
3.6000	0.060
3.8000	0.057
4.0000	0.057
4.2000	0.053
4.4000	0.053
4.6000	0.053
4.8000	0.053
5.0000	0.053
5.2000	0.057
5.4000	0.053
5.6000	0.053
5.8000	0.053
6.0000	0.053
6.2000	0.053
6.4000	0.050
6.6000	0.050
6.8000	0.047
7.0000	0.047
7.2000	0.044
7.4000	0.047
7.6000	0.044
7.8000	0.044
8.0000	0.044
8.2000	0.044

Elapsed Time	INPUT 1
8.4000	0.041
8.6000	0.041
8.8000	0.041
9.0000	0.041
9.2000	0.044
9.4000	0.041
9.6000	0.041
9.8000	0.041
10.0000	0.041
12.0000	0.047
14.0000	0.041
16.0000	0.038
18.0000	0.041
20.0000	0.041
22.0000	0.041
24.0000	0.038
26.0000	0.038
28.0000	0.038
30.0000	0.034
32.0000	0.038
34.0000	0.038
36.0000	0.038
38.0000	0.034
40.0000	0.038
42.0000	0.038



MODEL TYPE: BOUWER and RICE		for: USAEC	Well Slug Test Data
CONDUCTIVITY: .009745 ft/min		by: Ecology & Environment	Well: E3-P13-M02
TRANSMISSIVITY: .1381 sq. ft/min		WELL DATA: Units: ft AQUIFER: Endless THICKNESS: 14.18 SCREEN: top 9.000 base 19.00 DIAMETER: casing: .3400 intake: .3400 DEPTH: Water Table: 5.730 TD: 19.91	SUDBURY, MA SUDBURY
INITIAL HEAD: 3.549 ft			
Data Set: P13M2S0	Date: 09-23-93		

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P13-M03

Reference	0.000		Scale Factor	10.051
SG	1.000		Offset	-0.010
Linearity	0.004		Delay mSEC	50.000
Time	19:56		Date	09/23 /93
Logger Test	4		INPUT 1 Level (F)	

Step 0 09/23 13:33:13

Elapsed Time	INPUT 1	Elapsed Time	INPUT 1
0.0000	3.349	0.3250	2.250
0.0083	4.276	0.3333	2.234
0.0166	4.921	0.3500	2.209
0.0250	4.708	0.3666	2.181
0.0333	4.714	0.3833	2.155
0.0416	4.736	0.4000	2.130
0.0500	4.609	0.4166	2.101
0.0583	2.730	0.4333	2.079
0.0666	1.987	0.4500	2.054
0.0750	2.847	0.4666	2.028
0.0833	2.946	0.4833	2.006
0.0916	2.558	0.5000	1.980
0.1000	2.688	0.5166	1.955
0.1083	2.701	0.5333	1.933
0.1166	2.625	0.5500	1.911
0.1250	2.635	0.5666	1.888
0.1333	2.612	0.5833	1.866
0.1416	2.596	0.6000	1.844
0.1500	2.577	0.6166	1.825
0.1583	2.561	0.6333	1.803
0.1666	2.546	0.6500	1.780
0.1750	2.527	0.6666	1.761
0.1833	2.514	0.6833	1.742
0.1916	2.495	0.7000	1.720
0.2000	2.479	0.7166	1.701
0.2083	2.463	0.7333	1.682
0.2166	2.447	0.7500	1.663
0.2250	2.431	0.7666	1.647
0.2333	2.415	0.7833	1.625
0.2416	2.396	0.8000	1.612
0.2500	2.387	0.8166	1.590
0.2583	2.368	0.8333	1.574
0.2666	2.352	0.8500	1.558
0.2750	2.339	0.8666	1.536
0.2833	2.323	0.8833	1.523
0.2916	2.308	0.9000	1.511
0.3000	2.295	0.9166	1.495
0.3083	2.279	0.9333	1.479
0.3166	2.263	0.9500	1.463

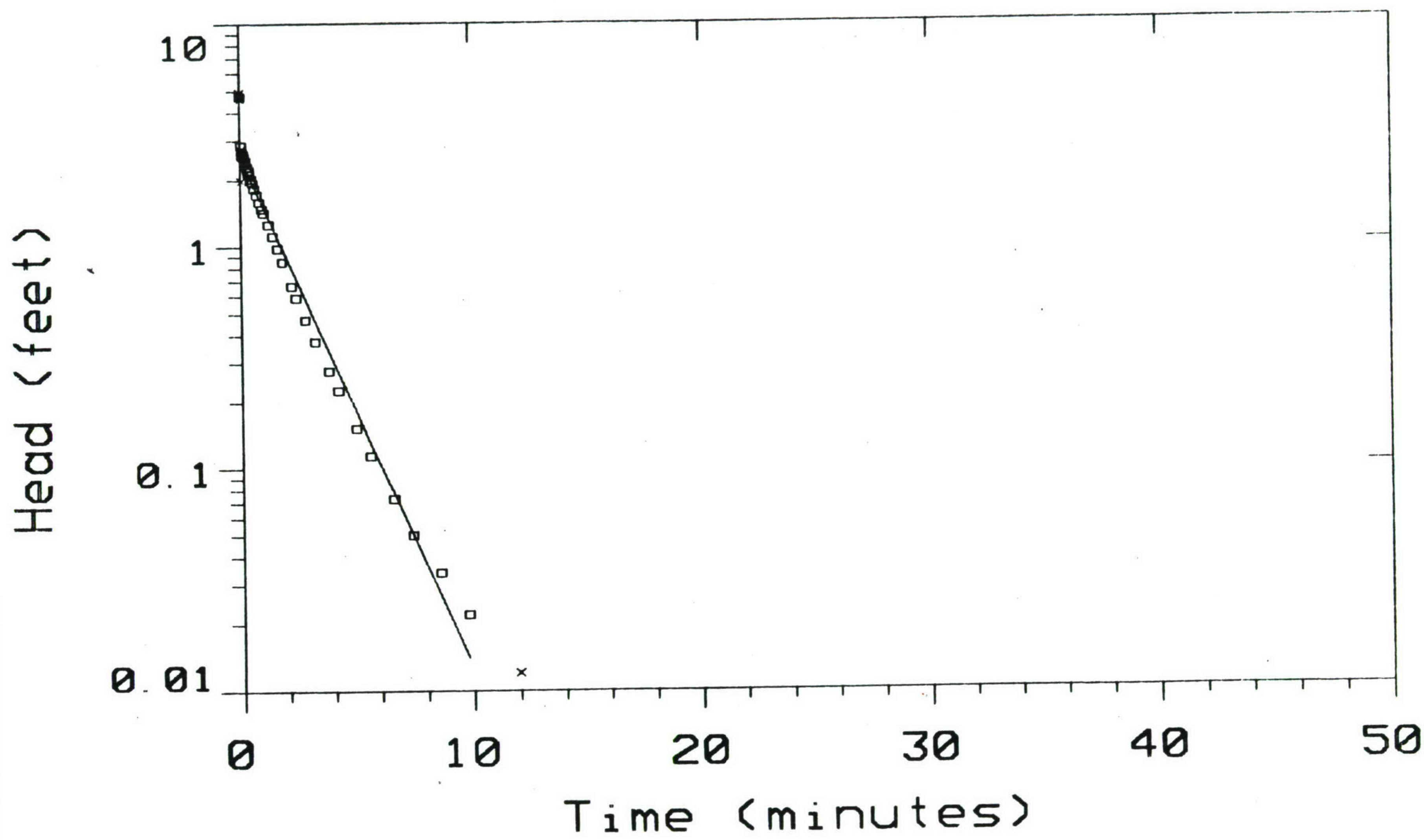
ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P13-M03

Reference	0.000		Scale Factor	10.051
SG	1.000		Offset	-0.010
Linearity	0.004		Delay mSEC	50.000
Time	19:56		Date	09/23 /93
Logger Test	4		INPUT 1 Level (F)	

Step 0 09/23 13:33:13

Elapsed Time	INPUT 1
0.9666	1.447
0.9833	1.438
1.0000	1.422
1.2000	1.257
1.4000	1.111
1.6000	0.977
1.8000	0.853
2.0000	0.755
2.2000	0.666
2.4000	0.590
2.6000	0.523
2.8000	0.469
3.0000	0.415
3.2000	0.374
3.4000	0.342
3.6000	0.304
3.8000	0.276
4.0000	0.247
4.2000	0.225
4.4000	0.203
4.6000	0.184
4.8000	0.168
5.0000	0.152
5.2000	0.139
5.4000	0.126
5.6000	0.114
5.8000	0.104
6.0000	0.095
6.2000	0.085
6.4000	0.079
6.6000	0.073
6.8000	0.066
7.0000	0.063
7.2000	0.057
7.4000	0.050
7.6000	0.050
7.8000	0.044
8.0000	0.044
8.2000	0.041

Elapsed Time	INPUT 1
8.4000	0.034
8.6000	0.034
8.8000	0.031
9.0000	0.031
9.2000	0.028
9.4000	0.025
9.6000	0.025
9.8000	0.022
10.0000	0.022
12.0000	0.012
14.0000	0.006
16.0000	0.003
18.0000	0.003
20.0000	0.003
22.0000	-0.003
24.0000	-0.003
26.0000	0.000
28.0000	-0.003
30.0000	-0.003



MODEL TYPE: BOUWER and RICE	
CONDUCTIVITY: .002561 ft/min	
TRANSMISSIVITY: .02815 sq. ft/min	
INITIAL HEAD: 4.921 ft	
Data Set: P13M3S0	Date: 09-23-93

for: USAEC
by: Ecology & Environment
WELL DATA: Units: ft
AQUIFER: Endless
THICKNESS: 10.99
SCREEN: top 8.000 base 18.00
DIAMETER: casing: .3400 intake: .3400
DEPTH: Water Table: 7.670 TD: 18.66

Well Slug Test Data

Well: E3-P13-M03
SUDBURY, MA
SUDBURY

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P37-M01

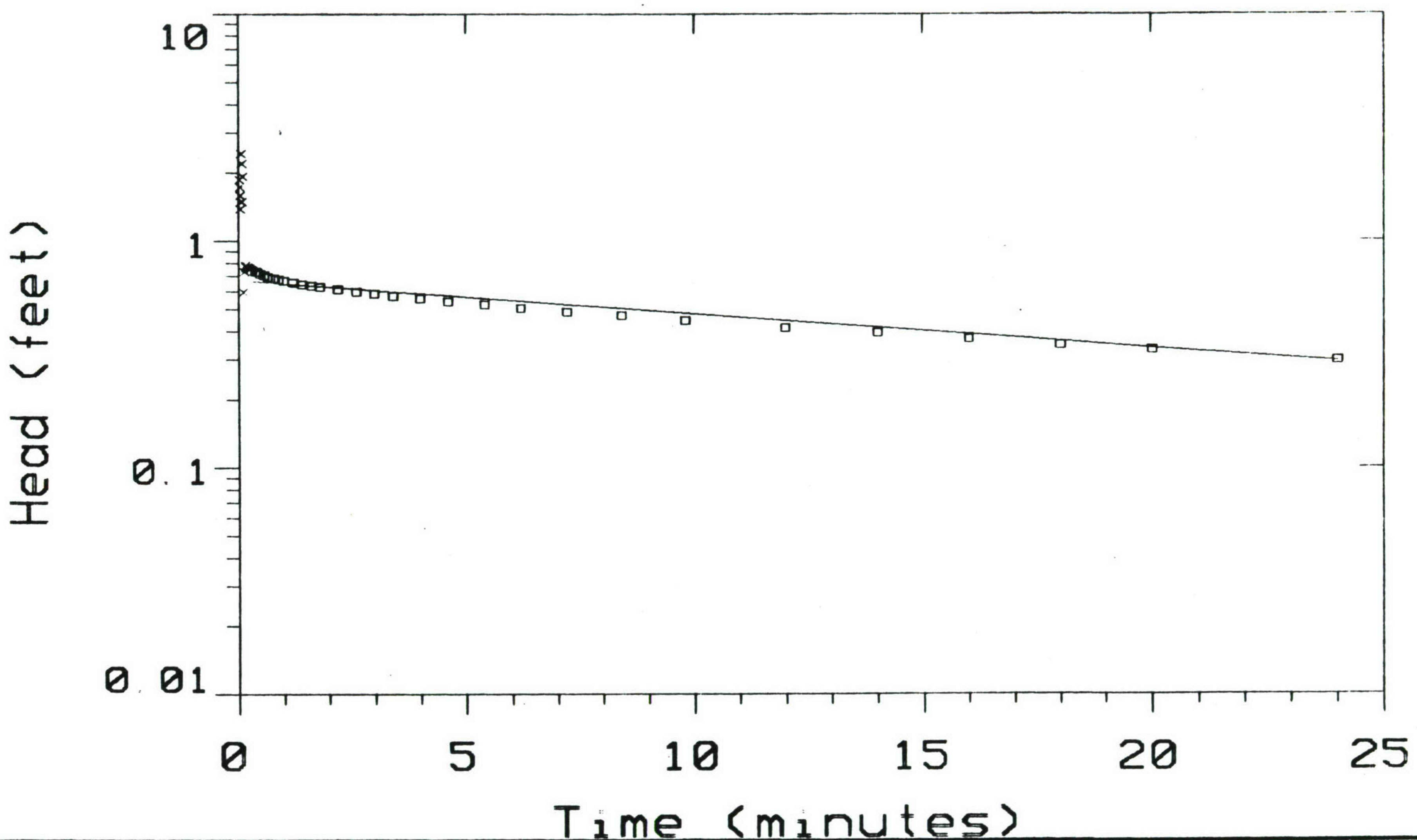
Reference	0.000
SG	1.000
Linearity	0.009
Time	20:29
Logger Test	3

Scale Factor	10.012
Offset	-0.042
Delay mSEC	50.000
Date	09/21 /93
INPUT 3 Level (F)	

Step 0 09/21 12:40:06

Elapsed Time	INPUT 3
0.9666	-0.670
0.9833	-0.667
1.0000	-0.667
1.2000	-0.654
1.4000	-0.645
1.6000	-0.635
1.8000	-0.626
2.0000	-0.619
2.2000	-0.610
2.4000	-0.604
2.6000	-0.597
2.8000	-0.591
3.0000	-0.585
3.2000	-0.578
3.4000	-0.572
3.6000	-0.566
3.8000	-0.562
4.0000	-0.556
4.2000	-0.550
4.4000	-0.547
4.6000	-0.540
4.8000	-0.537
5.0000	-0.531
5.2000	-0.528
5.4000	-0.525
5.6000	-0.521
5.8000	-0.515
6.0000	-0.512
6.2000	-0.506
6.4000	-0.502
6.6000	-0.499
6.8000	-0.496
7.0000	-0.490
7.2000	-0.487
7.4000	-0.483
7.6000	-0.480
7.8000	-0.474
8.0000	-0.474
8.2000	-0.471

Elapsed Time	INPUT 3
8.4000	-0.468
8.6000	-0.464
8.8000	-0.461
9.0000	-0.458
9.2000	-0.455
9.4000	-0.452
9.6000	-0.449
9.8000	-0.445
10.0000	-0.442
12.0000	-0.414
14.0000	-0.392
16.0000	-0.370
18.0000	-0.347
20.0000	-0.332
22.0000	-0.313
24.0000	-0.297
26.0000	-0.281
28.0000	-0.265
30.0000	-0.253
32.0000	-0.240
34.0000	-0.227
36.0000	-0.218
38.0000	-0.205
40.0000	-0.196
42.0000	-0.186
44.0000	-0.177
46.0000	-0.167
48.0000	-0.158
50.0000	-0.151
52.0000	-0.142
54.0000	-0.139
56.0000	-0.129
58.0000	-0.123
60.0000	-0.117



MODEL TYPE: BOUWER and RICE

CONDUCTIVITY: .0002519 ft/min

TRANSMISSIVITY: .001811 sq. ft/min

INITIAL HEAD: 1.872 ft

Data Set: P37M1S0

Date: 9-21-93

for: USAEC

by: Ecology & Environment

WELL DATA: Units: ft

AQUIFER: Endless

THICKNESS: 7.190

SCREEN: top: 11.00 base: 21.00

DIAMETER: casing: .3400 intake: .3400

DEPTH: Water Table: 13.95 TD: 21.14

Well Slug Test Data

Well: E3-P37-M01

SUDBURY, MA

SUDBURY

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P37-M02

Reference	0.000	Scale Factor	10.051
SG	1.000	Offset	-0.010
Linearity	0.004	Delay mSEC	50.000
Time	21:08	Date	09/21 /93
Logger Test	2	INPUT 1 Level	(F)

Step 0 09/21 11:24:27

Elapsed Time	INPUT 1
0.0000	0.000
0.0083	0.000
0.0166	-0.107
0.0250	0.238
0.0333	0.330
0.0416	0.425
0.0500	0.418
0.0583	0.418
0.0666	0.415
0.0750	0.409
0.0833	0.406
0.0916	0.403
0.1000	0.399
0.1083	0.396
0.1166	0.393
0.1250	0.393
0.1333	0.387
0.1416	0.387
0.1500	0.384
0.1583	0.380
0.1666	0.377
0.1750	0.377
0.1833	0.374
0.1916	0.371
0.2000	0.368
0.2083	0.368
0.2166	0.364
0.2250	0.361
0.2333	0.361
0.2416	0.358
0.2500	0.355
0.2583	0.352
0.2666	0.349
0.2750	0.349
0.2833	0.349
0.2916	0.345
0.3000	0.342
0.3083	0.342
0.3166	0.339

Elapsed Time	INPUT 1
0.3250	0.336
0.3333	0.336
0.3500	0.330
0.3666	0.326
0.3833	0.323
0.4000	0.320
0.4166	0.314
0.4333	0.311
0.4500	0.307
0.4666	0.304
0.4833	0.301
0.5000	0.295
0.5166	0.295
0.5333	0.288
0.5500	0.285
0.5666	0.282
0.5833	0.279
0.6000	0.276
0.6166	0.272
0.6333	0.269
0.6500	0.266
0.6666	0.263
0.6833	0.260
0.7000	0.257
0.7166	0.253
0.7333	0.250
0.7500	0.250
0.7666	0.247
0.7833	0.244
0.8000	0.241
0.8166	0.238
0.8333	0.234
0.8500	0.231
0.8666	0.231
0.8833	0.228
0.9000	0.225
0.9166	0.222
0.9333	0.218
0.9500	0.218

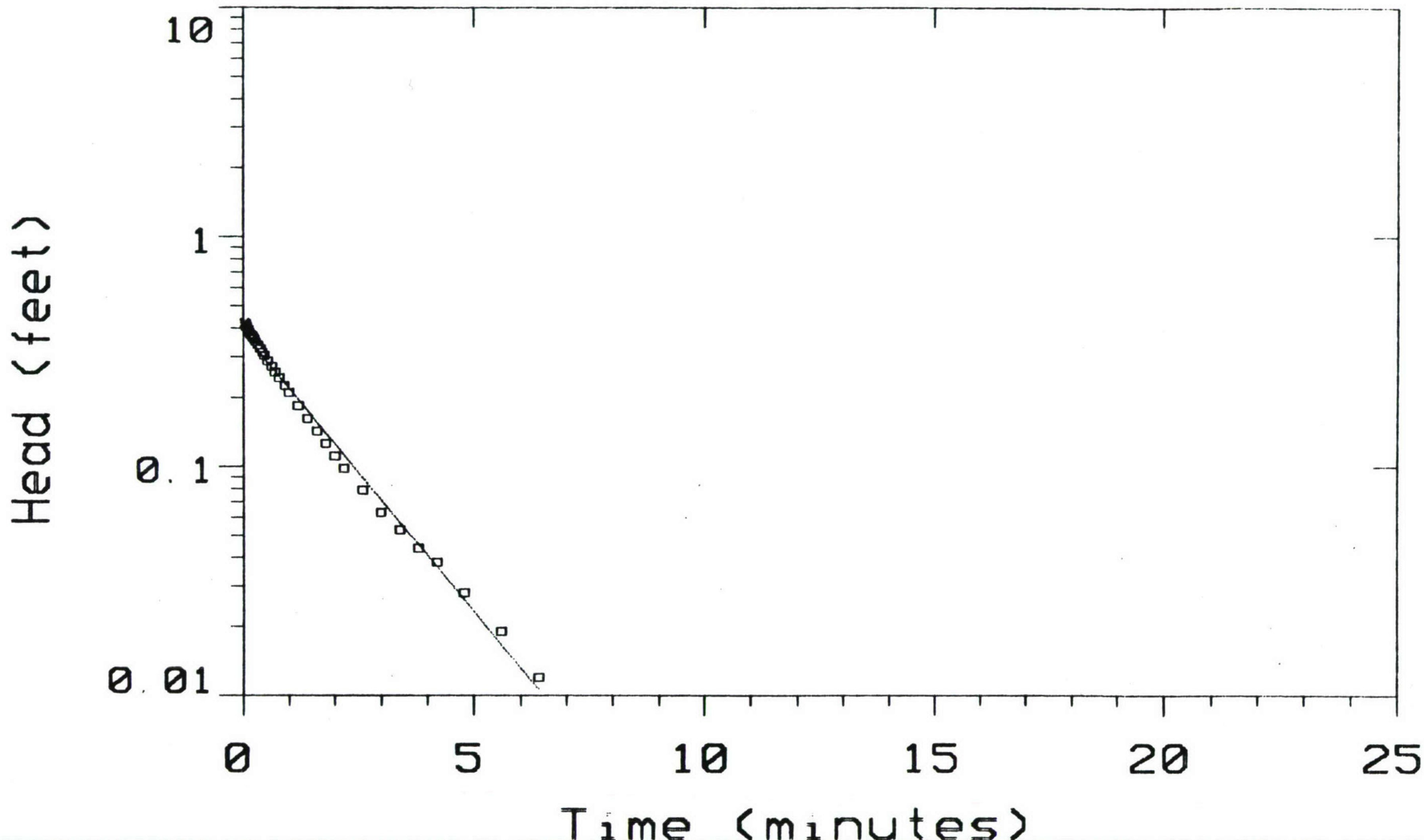
ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P37-M02

Reference	0.000		Scale Factor	10.051
SG	1.000		Offset	-0.010
Linearity	0.004		Delay mSEC	50.000
Time	21:08		Date	09/21 /93
Logger Test	2		INPUT 1 Level (F)	

Step 0 09/21 11:24:27

Elapsed Time	INPUT 1
0.9666	0.215
0.9833	0.212
1.0000	0.209
1.2000	0.184
1.4000	0.161
1.6000	0.142
1.8000	0.126
2.0000	0.111
2.2000	0.098
2.4000	0.088
2.6000	0.079
2.8000	0.069
3.0000	0.063
3.2000	0.057
3.4000	0.053
3.6000	0.047
3.8000	0.044
4.0000	0.038
4.2000	0.038
4.4000	0.034
4.6000	0.031
4.8000	0.028
5.0000	0.025
5.2000	0.022
5.4000	0.022
5.6000	0.019
5.8000	0.015
6.0000	0.015
6.2000	0.012
6.4000	0.012
6.6000	0.009
6.8000	0.009
7.0000	0.009
7.2000	0.009
7.4000	0.006
7.6000	0.006
7.8000	0.006
8.0000	0.006
8.2000	0.006

Elapsed Time	INPUT 1
8.4000	0.006
8.6000	0.003
8.8000	0.003
9.0000	0.003
9.2000	0.003
9.4000	0.003
9.6000	0.003
9.8000	0.003
10.0000	0.003
12.0000	0.003
14.0000	0.000
16.0000	0.000
18.0000	0.000



MODEL TYPE: BOUWER and RICE

CONDUCTIVITY: .001938 ft/min

TRANSMISSIVITY: .008779 sq. ft/min

INITIAL HEAD: .4250 ft

Data Set: P37M2S0 | Date: 9-21-93

for: **USAEC**

by: Ecology & Environment

WELL DATA: Units: ft

AQUIFER: Endless

THICKNESS: 4.530

SCREEN: top: 10.00 base: 20.00

DIAMETER: casing: .3400 intake: .3400

DEPTH: Water Table: 16.32 TD: 20.85

Well Slug Test Data

Well: E3-P37-M02

SUDBURY, MA

SUDBURY

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P37-M03

Reference	0.000
SG	1.000
Linearity	-0.000
Time	21:13
Logger Test	2

Scale Factor	9.990
Offset	-0.009
Delay mSEC	50.000
Date	09/21 /93

INPUT 2 Level (F)

Step 0 09/21 11:24:27

Elapsed Time	INPUT 2
0.0000	0.009
0.0083	0.009
0.0166	0.009
0.0250	0.009
0.0333	0.018
0.0416	0.015
0.0500	0.006
0.0583	0.012
0.0666	0.006
0.0750	0.668
0.0833	0.914
0.0916	0.334
0.1000	0.264
0.1083	0.460
0.1166	0.413
0.1250	0.447
0.1333	0.621
0.1416	0.365
0.1500	0.239
0.1583	0.287
0.1666	0.271
0.1750	0.261
0.1833	0.252
0.1916	0.242
0.2000	0.236
0.2083	0.230
0.2166	0.223
0.2250	0.220
0.2333	0.214
0.2416	0.211
0.2500	0.208
0.2583	0.205
0.2666	0.201
0.2750	0.198
0.2833	0.195
0.2916	0.192
0.3000	0.189
0.3083	0.186
0.3166	0.182

Elapsed Time	INPUT 2
0.3250	0.179
0.3333	0.176
0.3500	0.173
0.3666	0.167
0.3833	0.160
0.4000	0.157
0.4166	0.154
0.4333	0.148
0.4500	0.145
0.4666	0.141
0.4833	0.138
0.5000	0.135
0.5166	0.132
0.5333	0.126
0.5500	0.123
0.5666	0.119
0.5833	0.116
0.6000	0.113
0.6166	0.110
0.6333	0.107
0.6500	0.104
0.6666	0.100
0.6833	0.097
0.7000	0.097
0.7166	0.094
0.7333	0.091
0.7500	0.088
0.7666	0.088
0.7833	0.085
0.8000	0.082
0.8166	0.082
0.8333	0.078
0.8500	0.075
0.8666	0.075
0.8833	0.072
0.9000	0.072
0.9166	0.069
0.9333	0.069
0.9500	0.066

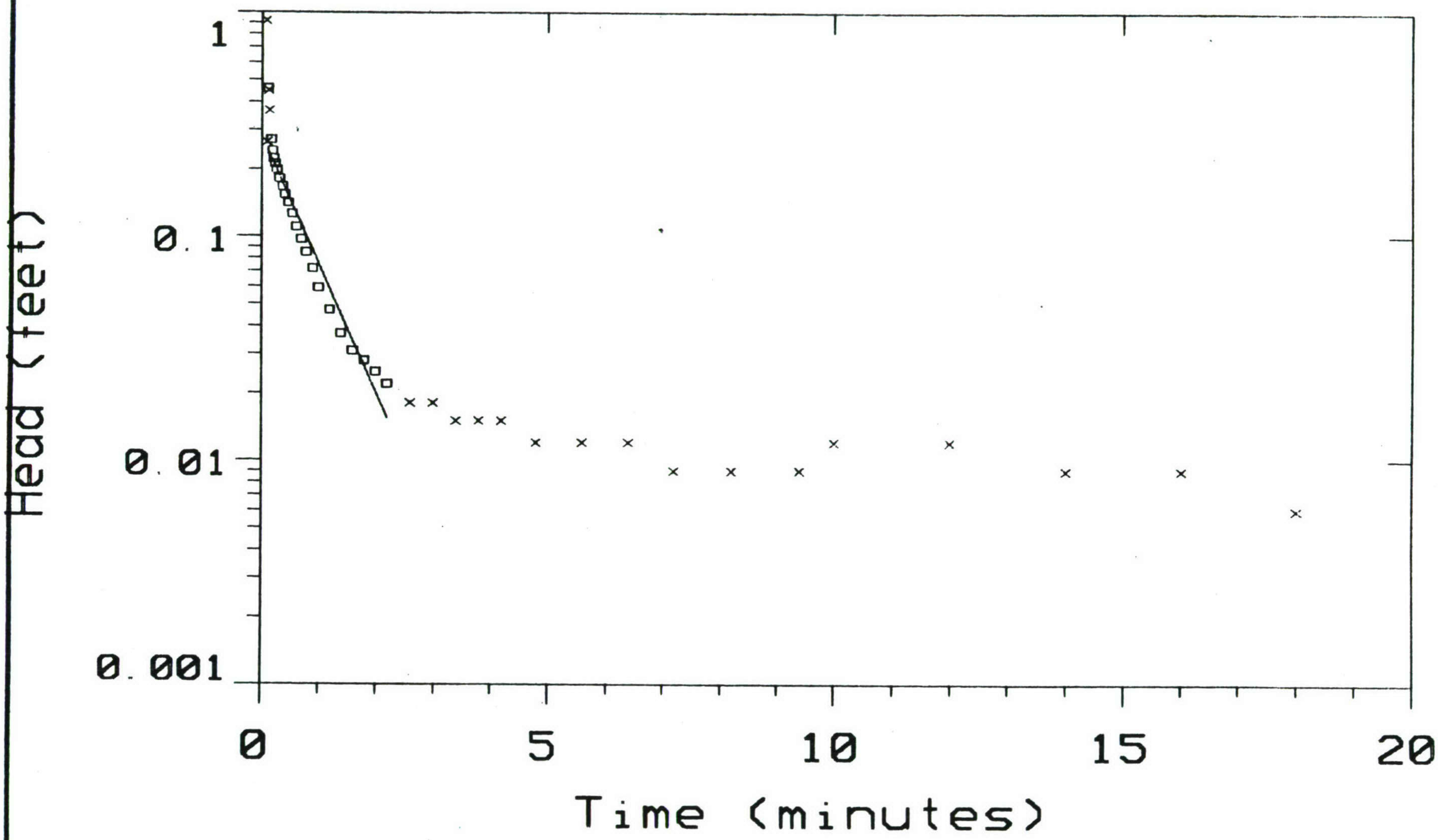
ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P37-M03

Reference	0.000		Scale Factor	9.990
SG	1.000		Offset	-0.009
Linearity	-0.000		Delay mSEC	50.000
Time	21:13		Date	09/21 /93
Logger Test	2		INPUT 2 Level (F)	

Step 0 09/21 11:24:27

Elapsed Time	INPUT 2
0.9666	0.063
0.9833	0.063
1.0000	0.059
1.2000	0.047
1.4000	0.037
1.6000	0.031
1.8000	0.028
2.0000	0.025
2.2000	0.022
2.4000	0.022
2.6000	0.018
2.8000	0.018
3.0000	0.018
3.2000	0.015
3.4000	0.015
3.6000	0.015
3.8000	0.015
4.0000	0.015
4.2000	0.015
4.4000	0.015
4.6000	0.015
4.8000	0.012
5.0000	0.012
5.2000	0.012
5.4000	0.012
5.6000	0.012
5.8000	0.012
6.0000	0.012
6.2000	0.012
6.4000	0.012
6.6000	0.009
6.8000	0.009
7.0000	0.012
7.2000	0.009
7.4000	0.009
7.6000	0.009
7.8000	0.009
8.0000	0.009
8.2000	0.009

Elapsed Time	INPUT 2
8.4000	0.009
8.6000	0.009
8.8000	0.009
9.0000	0.009
9.2000	0.009
9.4000	0.009
9.6000	0.009
9.8000	0.009
10.0000	0.012
12.0000	0.012
14.0000	0.009
16.0000	0.009
18.0000	0.006



MODEL TYPE: BOUWER and RICE	for: USAEC	Well Slug Test Data
CONDUCTIVITY: .005847 ft/min	by: Ecology & Environment	Well: E3-P37-M03
TRANSMISSIVITY: .02859 sq. ft/min	WELL DATA: Units: ft	SUDBURY, MA
INITIAL HEAD: .9140 ft	AQUIFER: Endless	SUDBURY
Data Set: P37M3S0	THICKNESS: 4.890	
Date: 9-21-93	SCREEN: top: 10.00 base: 20.00	
	DIAMETER: casing: .3400 intake: .3400	
	DEPTH: Water Table: 16.93 TD: 21.82	

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P11-M01X

Reference	0.000	Scale Factor	10.051
SG	1.000	Offset	-0.010
Linearity	0.004	Delay mSEC	50.000
Time	20:08	Date	09/23 /93
Logger Test	1	INPUT 1 Level (F)	

Step 1 09/23 09:17:42

Elapsed Time	INPUT 1	Elapsed Time	INPUT 1
0.0000	-3.094	0.3250	-1.755
0.0083	-3.021	0.3333	-1.739
0.0166	-2.942	0.3500	-1.714
0.0250	-2.891	0.3666	-1.691
0.0333	-2.837	0.3833	-1.666
0.0416	-2.767	0.4000	-1.647
0.0500	-2.713	0.4166	-1.625
0.0583	-2.659	0.4333	-1.606
0.0666	-2.615	0.4500	-1.587
0.0750	-2.571	0.4666	-1.568
0.0833	-2.523	0.4833	-1.549
0.0916	-2.475	0.5000	-1.533
0.1000	-2.431	0.5166	-1.517
0.1083	-2.393	0.5333	-1.501
0.1166	-2.355	0.5500	-1.485
0.1250	-2.317	0.5666	-1.472
0.1333	-2.279	0.5833	-1.460
0.1416	-2.244	0.6000	-1.450
0.1500	-2.202	0.6166	-1.441
0.1583	-2.177	0.6333	-1.431
0.1666	-2.133	0.6500	-1.422
0.1750	-2.107	0.6666	-1.415
0.1833	-2.075	0.6833	-1.406
0.1916	-2.053	0.7000	-1.399
0.2000	-2.025	0.7166	-1.393
0.2083	-2.006	0.7333	-1.387
0.2166	-1.980	0.7500	-1.380
0.2250	-1.961	0.7666	-1.377
0.2333	-1.936	0.7833	-1.371
0.2416	-1.917	0.8000	-1.368
0.2500	-1.898	0.8166	-1.361
0.2583	-1.879	0.8333	-1.358
0.2666	-1.860	0.8500	-1.355
0.2750	-1.844	0.8666	-1.352
0.2833	-1.828	0.8833	-1.349
0.2916	-1.812	0.9000	-1.345
0.3000	-1.796	0.9166	-1.342
0.3083	-1.783	0.9333	-1.339
0.3166	-1.768	0.9500	-1.336

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P11-M01X

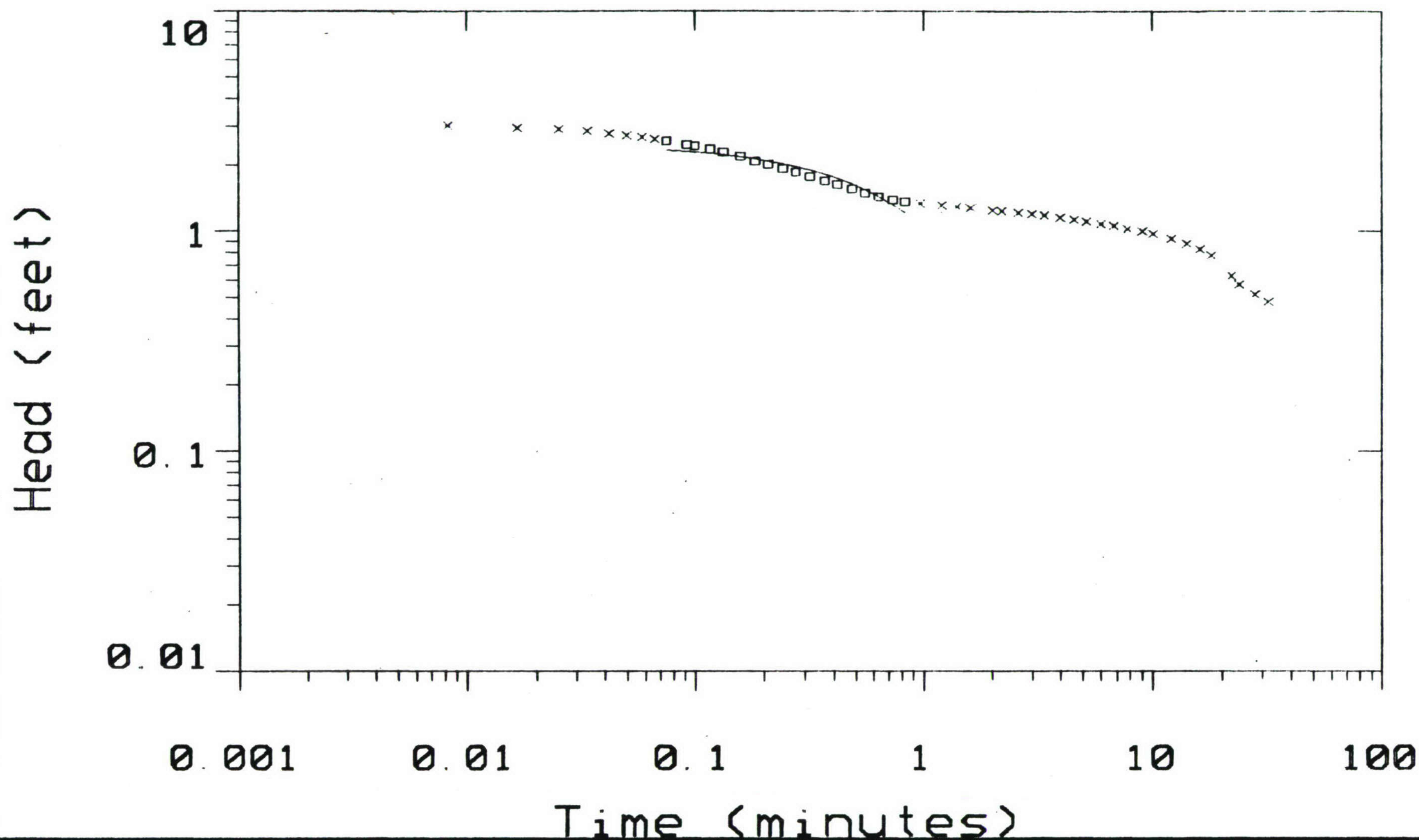
Reference	0.000
SG	1.000
Linearity	0.004
Time	20:08
Logger Test	1

Scale Factor	10.051
Offset	-0.010
Delay mSEC	50.000
Date	09/23 /93
INPUT 1 Level	(F)

Step 1 09/23 09:17:42

Elapsed Time	INPUT 1
0.9666	-1.333
0.9833	-1.333
1.0000	-1.330
1.2000	-1.304
1.4000	-1.285
1.6000	-1.269
1.8000	-1.253
2.0000	-1.241
2.2000	-1.228
2.4000	-1.218
2.6000	-1.209
2.8000	-1.199
3.0000	-1.190
3.2000	-1.180
3.4000	-1.174
3.6000	-1.164
3.8000	-1.158
4.0000	-1.149
4.2000	-1.142
4.4000	-1.133
4.6000	-1.126
4.8000	-1.120
5.0000	-1.114
5.2000	-1.107
5.4000	-1.101
5.6000	-1.095
5.8000	-1.085
6.0000	-1.079
6.2000	-1.072
6.4000	-1.069
6.6000	-1.063
6.8000	-1.057
7.0000	-1.050
7.2000	-1.044
7.4000	-1.037
7.6000	-1.034
7.8000	-1.025
8.0000	-1.022
8.2000	-1.015

Elapsed Time	INPUT 1
8.4000	-1.009
8.6000	-1.006
8.8000	-0.999
9.0000	-0.993
9.2000	-0.990
9.4000	-0.984
9.6000	-0.977
9.8000	-0.974
10.0000	-0.968
12.0000	-0.920
14.0000	-0.876
16.0000	-0.828
18.0000	-0.777
20.0000	-0.707
22.0000	-0.625
24.0000	-0.574
26.0000	-0.542
28.0000	-0.517
30.0000	-0.498
32.0000	-0.479



MODEL TYPE: BOUWER and RICE	
CONDUCTIVITY: .004169 ft/min	
TRANSMISSIVITY: .03656 sq. ft/min	
INITIAL HEAD: 3.021 ft	
Data Set: P11M1S1	Date: 9-23-93

for: **USAEC**
by: Ecology & Environment
WELL DATA: Units: ft
AQUIFER: Endless
THICKNESS: 8.770
SCREEN: top: 6.000 base: 16.00
DIAMETER: casing: .3400 intake: .3400
DEPTH: Water Table: 9.440 TD: 18.21

Well Slug Test Data

Well: E3-P11-M01
SUDBURY, MA
SUDBURY

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P13-M01X

Reference	0.000	Scale Factor	9.990
SG	1.000	Offset	-0.009
Linearity	-0.000	Delay mSEC	50.000
Time	19:42	Date	09/22 /93
Logger Test	7	INPUT 1 Level	(F)

Step 1 09/22 17:06:54

Elapsed Time	INPUT 1	Elapsed Time	INPUT 1
0.0000	-1.274	0.3250	-0.788
0.0083	-1.255	0.3333	-0.779
0.0166	-1.226	0.3500	-0.763
0.0250	-1.207	0.3666	-0.750
0.0333	-1.192	0.3833	-0.734
0.0416	-1.176	0.4000	-0.719
0.0500	-1.160	0.4166	-0.703
0.0583	-1.141	0.4333	-0.687
0.0666	-1.122	0.4500	-0.674
0.0750	-1.110	0.4666	-0.662
0.0833	-1.097	0.4833	-0.646
0.0916	-1.081	0.5000	-0.633
0.1000	-1.069	0.5166	-0.621
0.1083	-1.053	0.5333	-0.608
0.1166	-1.040	0.5500	-0.599
0.1250	-1.028	0.5666	-0.583
0.1333	-1.018	0.5833	-0.574
0.1416	-1.006	0.6000	-0.561
0.1500	-0.990	0.6166	-0.551
0.1583	-0.980	0.6333	-0.539
0.1666	-0.971	0.6500	-0.529
0.1750	-0.958	0.6666	-0.520
0.1833	-0.949	0.6833	-0.507
0.1916	-0.939	0.7000	-0.501
0.2000	-0.930	0.7166	-0.492
0.2083	-0.917	0.7333	-0.482
0.2166	-0.908	0.7500	-0.473
0.2250	-0.898	0.7666	-0.463
0.2333	-0.886	0.7833	-0.454
0.2416	-0.879	0.8000	-0.447
0.2500	-0.870	0.8166	-0.438
0.2583	-0.861	0.8333	-0.432
0.2666	-0.851	0.8500	-0.422
0.2750	-0.842	0.8666	-0.416
0.2833	-0.832	0.8833	-0.406
0.2916	-0.823	0.9000	-0.400
0.3000	-0.813	0.9166	-0.394
0.3083	-0.807	0.9333	-0.387
0.3166	-0.797	0.9500	-0.381

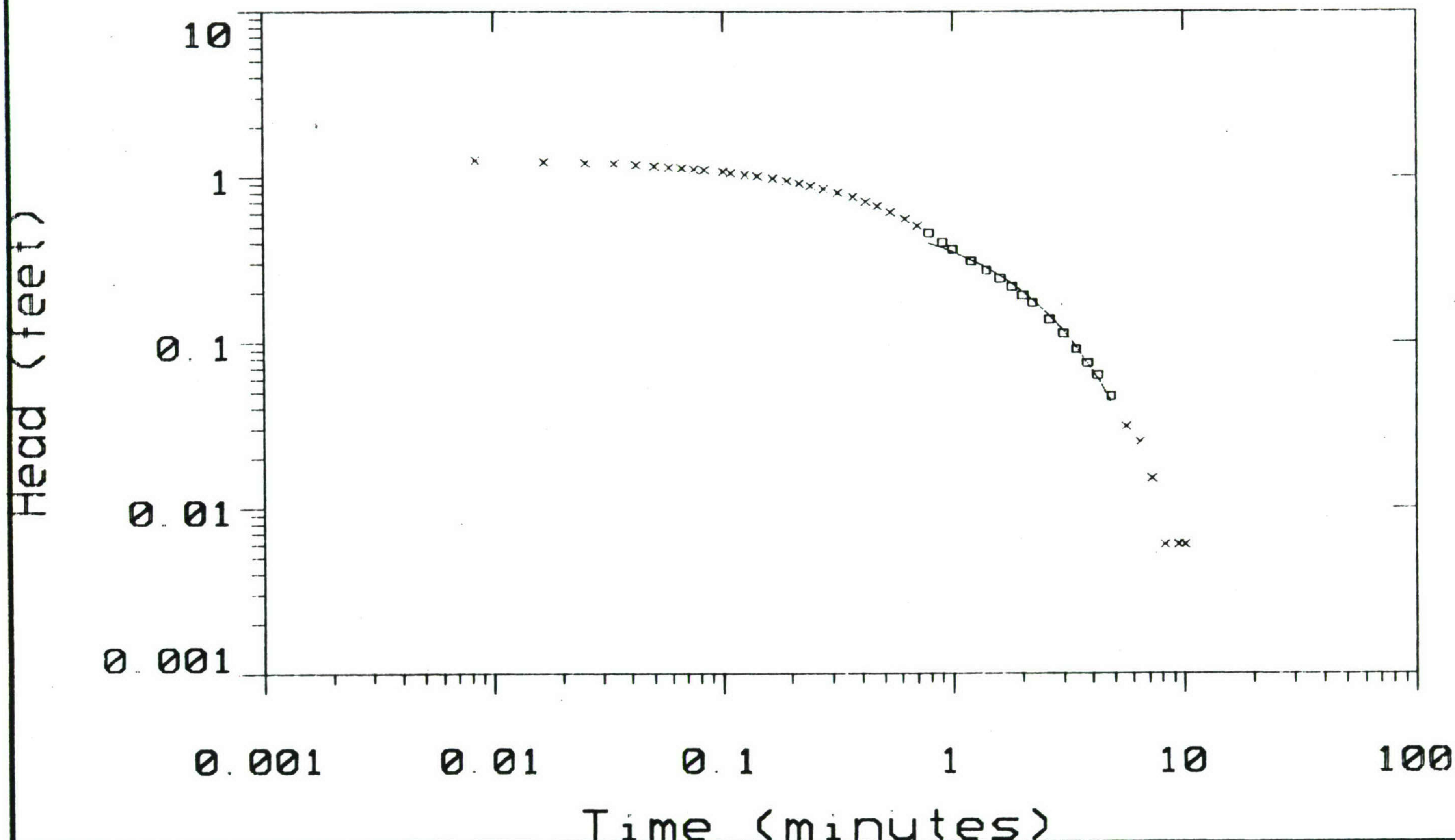
ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P13-M01X

Reference	0.000		Scale Factor	9.990
SG	1.000		Offset	-0.009
Linearity	-0.000		Delay mSEC	50.000
Time	19:42		Date	09/22 /93
Logger Test	7		INPUT 1 Level	(F)

Step 1 09/22 17:06:54

Elapsed Time	INPUT 1
0.9666	-0.375
0.9833	-0.369
1.0000	-0.362
1.2000	-0.309
1.4000	-0.271
1.6000	-0.242
1.8000	-0.217
2.0000	-0.192
2.2000	-0.173
2.4000	-0.154
2.6000	-0.138
2.8000	-0.126
3.0000	-0.113
3.2000	-0.100
3.4000	-0.091
3.6000	-0.082
3.8000	-0.075
4.0000	-0.069
4.2000	-0.063
4.4000	-0.059
4.6000	-0.050
4.8000	-0.047
5.0000	-0.044
5.2000	-0.041
5.4000	-0.037
5.6000	-0.031
5.8000	-0.031
6.0000	-0.028
6.2000	-0.025
6.4000	-0.025
6.6000	-0.022
6.8000	-0.018
7.0000	-0.018
7.2000	-0.015
7.4000	-0.015
7.6000	-0.012
7.8000	-0.012
8.0000	-0.009
8.2000	-0.006

Elapsed Time	INPUT 1
8.4000	-0.009
8.6000	-0.009
8.8000	-0.006
9.0000	-0.009
9.2000	-0.006
9.4000	-0.006
9.6000	-0.006
9.8000	-0.003
10.0000	-0.006
12.0000	0.000
14.0000	0.000
16.0000	0.000
18.0000	0.006



MODEL TYPE BOUWER and RICE CONDUCTIVITY .002455 ft/min TRANSMISSIVITY .01461 sq ft/min INITIAL HEAD 1.255 ft Data Set P13M1S1 Date 9-22-93	for: USAEC by: Ecology & Environment WELL DATA Units ft AQUIFER Endless THICKNESS 5.950 SCREEN top 9.000 base 19.00 DIAMETER casing .3400 intake .3400 DEPTH Water Table 14.51 TD 20.46	Well Slug Test Data Well: E3-P13-M01 SUDBURY, MA SUDBURY

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P13-M02X

Reference	0.000	Scale Factor	10.051
SG	1.000	Offset	-0.010
Linearity	0.004	Delay mSEC	50.000
Time	20:01	Date	09/23 /93
Logger Test	3	INPUT 1 Level	(F)

Step 1 09/23 11:48:26

Elapsed Time	INPUT 1	Elapsed Time	INPUT 1
0.0000	-1.111	0.3250	-0.485
0.0083	-0.638	0.3333	-0.466
0.0166	-1.679	0.3500	-0.434
0.0250	-2.692	0.3666	-0.409
0.0333	-2.876	0.3833	-0.384
0.0416	-2.615	0.4000	-0.358
0.0500	-2.435	0.4166	-0.339
0.0583	-2.269	0.4333	-0.320
0.0666	-2.120	0.4500	-0.304
0.0750	-1.981	0.4666	-0.288
0.0833	-1.860	0.4833	-0.276
0.0916	-1.752	0.5000	-0.263
0.1000	-1.657	0.5166	-0.250
0.1083	-1.542	0.5333	-0.238
0.1166	-1.568	0.5500	-0.228
0.1250	-1.466	0.5666	-0.219
0.1333	-1.308	0.5833	-0.209
0.1416	-1.447	0.6000	-0.203
0.1500	-1.193	0.6166	-0.193
0.1583	-1.123	0.6333	-0.187
0.1666	-1.069	0.6500	-0.177
0.1750	-1.015	0.6666	-0.171
0.1833	-0.965	0.6833	-0.165
0.1916	-0.923	0.7000	-0.161
0.2000	-0.879	0.7166	-0.152
0.2083	-0.841	0.7333	-0.149
0.2166	-0.803	0.7500	-0.142
0.2250	-0.768	0.7666	-0.139
0.2333	-0.739	0.7833	-0.136
0.2416	-0.707	0.8000	-0.130
0.2500	-0.679	0.8166	-0.126
0.2583	-0.650	0.8333	-0.123
0.2666	-0.628	0.8500	-0.120
0.2750	-0.603	0.8666	-0.117
0.2833	-0.581	0.8833	-0.114
0.2916	-0.558	0.9000	-0.111
0.3000	-0.539	0.9166	-0.107
0.3083	-0.520	0.9333	-0.107
0.3166	-0.501	0.9500	-0.104

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P13-M02X

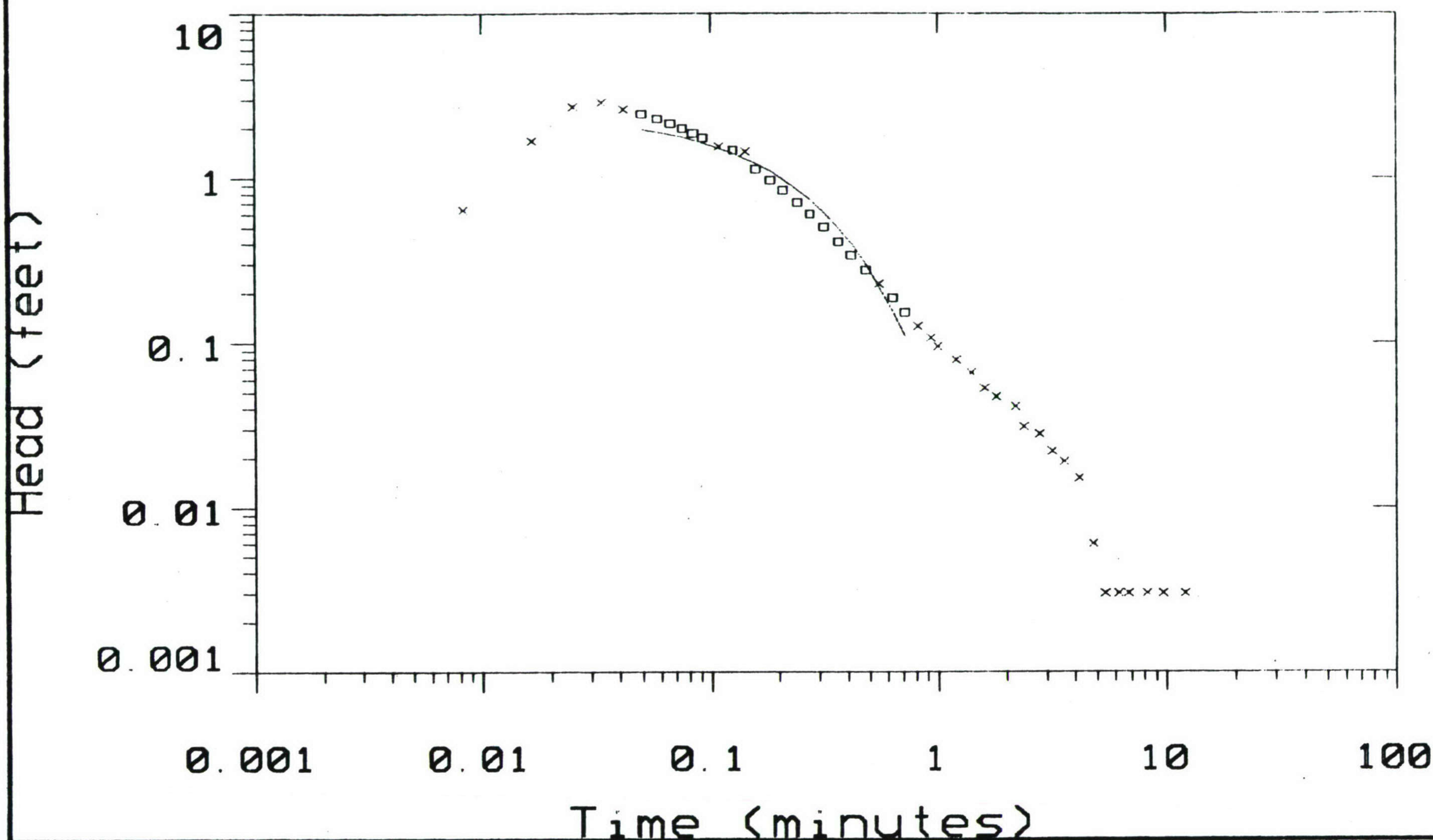
Reference	0.000
SG	1.000
Linearity	0.004
Time	20:01
Logger Test	3

Scale Factor	10.051
Offset	-0.010
Delay mSEC	50.000
Date	09/23 /93
INPUT 1 Level	(F)

Step 1 09/23 11:48:26

Elapsed Time	INPUT 1
0.9666	-0.101
0.9833	-0.098
1.0000	-0.095
1.2000	-0.079
1.4000	-0.066
1.6000	-0.053
1.8000	-0.047
2.0000	-0.041
2.2000	-0.041
2.4000	-0.031
2.6000	-0.034
2.8000	-0.028
3.0000	-0.025
3.2000	-0.022
3.4000	-0.022
3.6000	-0.019
3.8000	-0.019
4.0000	-0.015
4.2000	-0.015
4.4000	-0.012
4.6000	-0.009
4.8000	-0.006
5.0000	-0.006
5.2000	-0.003
5.4000	-0.003
5.6000	-0.003
5.8000	-0.003
6.0000	-0.003
6.2000	-0.003
6.4000	-0.003
6.6000	-0.003
6.8000	-0.003
7.0000	0.000
7.2000	0.000
7.4000	0.000
7.6000	-0.003
7.8000	-0.003
8.0000	0.000
8.2000	-0.003

Elapsed Time	INPUT 1
8.4000	-0.003
8.6000	0.000
8.8000	0.000
9.0000	0.000
9.2000	0.000
9.4000	0.000
9.6000	-0.003
9.8000	0.000
10.0000	0.000
12.0000	-0.003
14.0000	0.000
16.0000	0.000
18.0000	0.006
20.0000	0.003
22.0000	0.003
24.0000	0.000



MODEL TYPE: BOUWER and RICE CONDUCTIVITY: .01059 ft/min TRANSMISSIVITY: .1502 sq. ft/min INITIAL HEAD: .6380 ft Data Set: P13M2S1 Date: 9-23-93	for: USAEC by: Ecology & Environment WELL DATA: Units: ft AQUIFER: Endless THICKNESS: 14.18 SCREEN: top 8.000 base 18.00 DIAMETER: casing .3400 intake .3400 DEPTH: Water Table 5.730 TD 19.91	Well Slug Test Data Well: E3-P13-M02 SUDBURY, MA SUDBURY

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P13-M03X

Reference	0.000	Scale Factor	10.051
SG	1.000	Offset	-0.010
Linearity	0.004	Delay mSEC	50.000
Time	19:58	Date	09/23 /93
Logger Test	4	INPUT 1 Level (F)	

Step 1 09/23 14:03:49

Elapsed Time	INPUT 1	Elapsed Time	INPUT 1
0.0000	-3.152	0.3250	-2.295
0.0083	-3.440	0.3333	-2.282
0.0166	-3.380	0.3500	-2.260
0.0250	-3.304	0.3666	-2.241
0.0333	-3.244	0.3833	-2.203
0.0416	-3.202	0.4000	-2.183
0.0500	-3.133	0.4166	-2.161
0.0583	-3.110	0.4333	-2.142
0.0666	-3.053	0.4500	-2.120
0.0750	-3.031	0.4666	-2.101
0.0833	-2.977	0.4833	-2.085
0.0916	-2.942	0.5000	-2.066
0.1000	-2.910	0.5166	-2.047
0.1083	-2.869	0.5333	-2.028
0.1166	-2.841	0.5500	-2.009
0.1250	-2.812	0.5666	-1.990
0.1333	-2.780	0.5833	-1.968
0.1416	-2.748	0.6000	-1.945
0.1500	-2.729	0.6166	-1.926
0.1583	-2.701	0.6333	-1.907
0.1666	-2.682	0.6500	-1.885
0.1750	-2.650	0.6666	-1.866
0.1833	-2.631	0.6833	-1.847
0.1916	-2.590	0.7000	-1.828
0.2000	-2.564	0.7166	-1.809
0.2083	-2.542	0.7333	-1.790
0.2166	-2.523	0.7500	-1.771
0.2250	-2.501	0.7666	-1.752
0.2333	-2.479	0.7833	-1.736
0.2416	-2.456	0.8000	-1.717
0.2500	-2.437	0.8166	-1.701
0.2583	-2.422	0.8333	-1.685
0.2666	-2.403	0.8500	-1.669
0.2750	-2.383	0.8666	-1.653
0.2833	-2.368	0.8833	-1.638
0.2916	-2.352	0.9000	-1.622
0.3000	-2.336	0.9166	-1.606
0.3083	-2.323	0.9333	-1.587
0.3166	-2.307	0.9500	-1.568

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P13-M03X

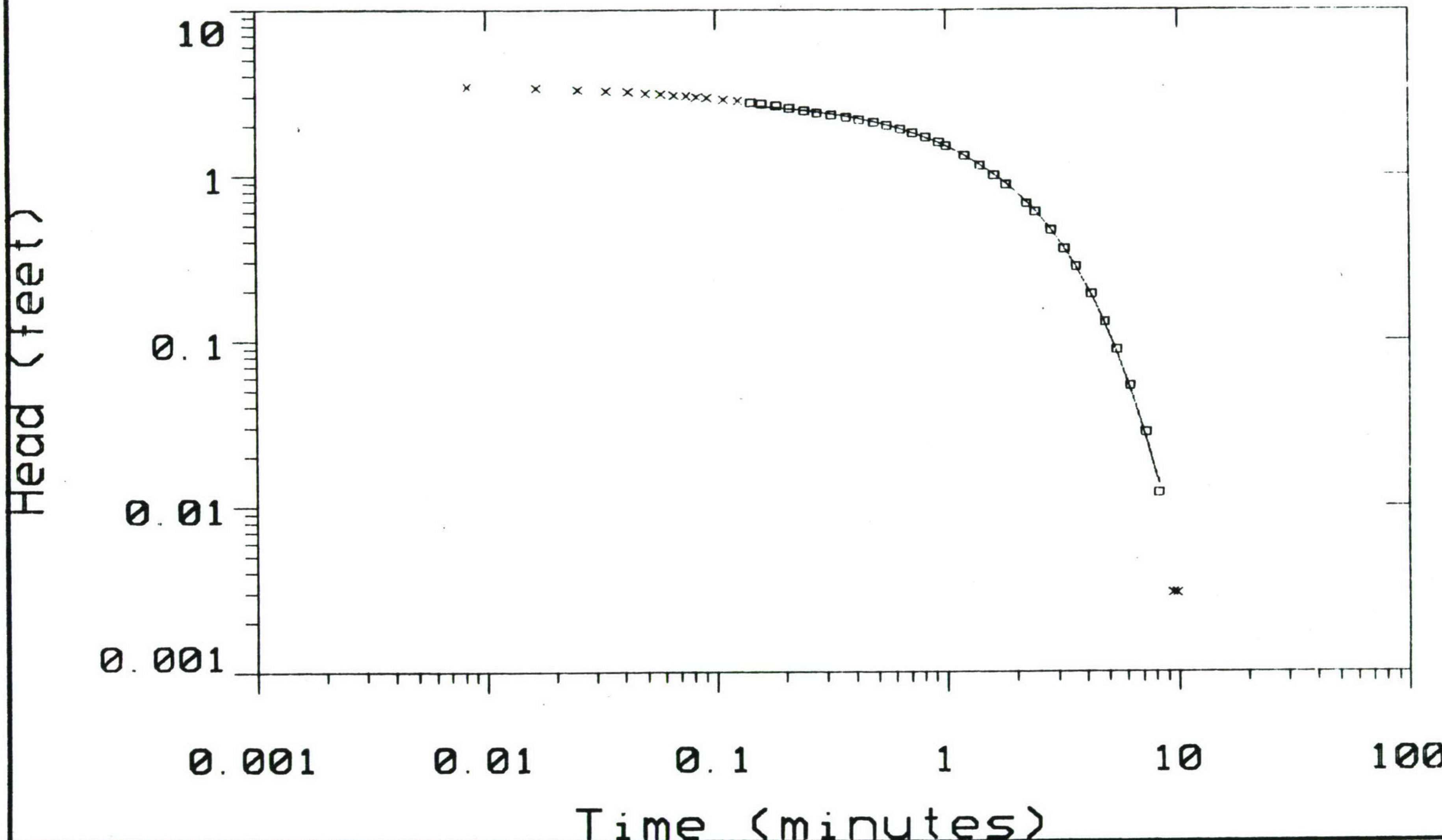
Reference	0.000
SG	1.000
Linearity	0.004
Time	19:58
Logger Test	4

Scale Factor	10.051
Offset	-0.010
Delay mSEC	50.000
Date	09/23 /93
INPUT 1 Level	(F)

Step 1 09/23 14:03:49

Elapsed Time	INPUT 1
0.9666	-1.549
0.9833	-1.533
1.0000	-1.514
1.2000	-1.314
1.4000	-1.145
1.6000	-1.003
1.8000	-0.879
2.0000	-0.771
2.2000	-0.676
2.4000	-0.596
2.6000	-0.523
2.8000	-0.460
3.0000	-0.403
3.2000	-0.358
3.4000	-0.317
3.6000	-0.279
3.8000	-0.247
4.0000	-0.219
4.2000	-0.190
4.4000	-0.168
4.6000	-0.146
4.8000	-0.130
5.0000	-0.114
5.2000	-0.101
5.4000	-0.088
5.6000	-0.079
5.8000	-0.069
6.0000	-0.060
6.2000	-0.053
6.4000	-0.047
6.6000	-0.044
6.8000	-0.034
7.0000	-0.034
7.2000	-0.028
7.4000	-0.022
7.6000	-0.022
7.8000	-0.015
8.0000	-0.015
8.2000	-0.012

Elapsed Time	INPUT 1
8.4000	-0.012
8.6000	-0.009
8.8000	-0.006
9.0000	-0.006
9.2000	-0.006
9.4000	-0.003
9.6000	-0.003
9.8000	-0.003
10.0000	0.000
12.0000	0.006
14.0000	0.006
16.0000	0.003
18.0000	0.006
20.0000	0.006
22.0000	0.006
24.0000	0.006



MODEL TYPE: BOUWER and RICE	
CONDUCTIVITY: .002889 ft/min	
TRANSMISSIVITY: .03175 sq. ft/min	
INITIAL HEAD: 3.440 ft	
Data Set: P13M3S1	Date: 9-23-93

for:	USAEC
by:	Ecology & Environment
WELL DATA: Units: ft	
AQUIFER: Endless	
THICKNESS: 10.99	
SCREEN: top: 8.000 base: 18.00	
DIAMETER: casing: 3400 intake: 3400	
DEPTH: Water Table: 7.670 TD: 18.66	

Well Slug Test Data

Well: E3-P13-M03

SUDBURY, MA

SUDBURY

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P13-M04X

Reference	0.000	Scale Factor	10.051
SG	1.000	Offset	-0.010
Linearity	0.004	Delay mSEC	50.000
Time	20:05	Date	09/23 /93
Logger Test	2	INPUT 1 Level	(F)

Step 1 09/23 10:32:39

Elapsed Time	INPUT 1
0.0000	-1.752
0.0083	-2.196
0.0166	-2.520
0.0250	-3.015
0.0333	-3.190
0.0416	-3.079
0.0500	-2.990
0.0583	-2.904
0.0666	-2.822
0.0750	-2.733
0.0833	-2.657
0.0916	-2.571
0.1000	-2.498
0.1083	-2.422
0.1166	-2.368
0.1250	-2.298
0.1333	-2.215
0.1416	-2.171
0.1500	-2.092
0.1583	-2.069
0.1666	-1.977
0.1750	-1.914
0.1833	-1.892
0.1916	-1.812
0.2000	-1.765
0.2083	-1.717
0.2166	-1.669
0.2250	-1.625
0.2333	-1.587
0.2416	-1.549
0.2500	-1.514
0.2583	-1.476
0.2666	-1.444
0.2750	-1.412
0.2833	-1.384
0.2916	-1.355
0.3000	-1.326
0.3083	-1.301
0.3166	-1.276

Elapsed Time	INPUT 1
0.3250	-1.253
0.3333	-1.231
0.3500	-1.190
0.3666	-1.152
0.3833	-1.117
0.4000	-1.085
0.4166	-1.057
0.4333	-1.031
0.4500	-1.006
0.4666	-0.980
0.4833	-0.961
0.5000	-0.942
0.5166	-0.923
0.5333	-0.904
0.5500	-0.888
0.5666	-0.873
0.5833	-0.857
0.6000	-0.841
0.6166	-0.828
0.6333	-0.812
0.6500	-0.800
0.6666	-0.787
0.6833	-0.774
0.7000	-0.761
0.7166	-0.752
0.7333	-0.739
0.7500	-0.730
0.7666	-0.717
0.7833	-0.707
0.8000	-0.695
0.8166	-0.685
0.8333	-0.676
0.8500	-0.666
0.8666	-0.657
0.8833	-0.647
0.9000	-0.638
0.9166	-0.628
0.9333	-0.619
0.9500	-0.612

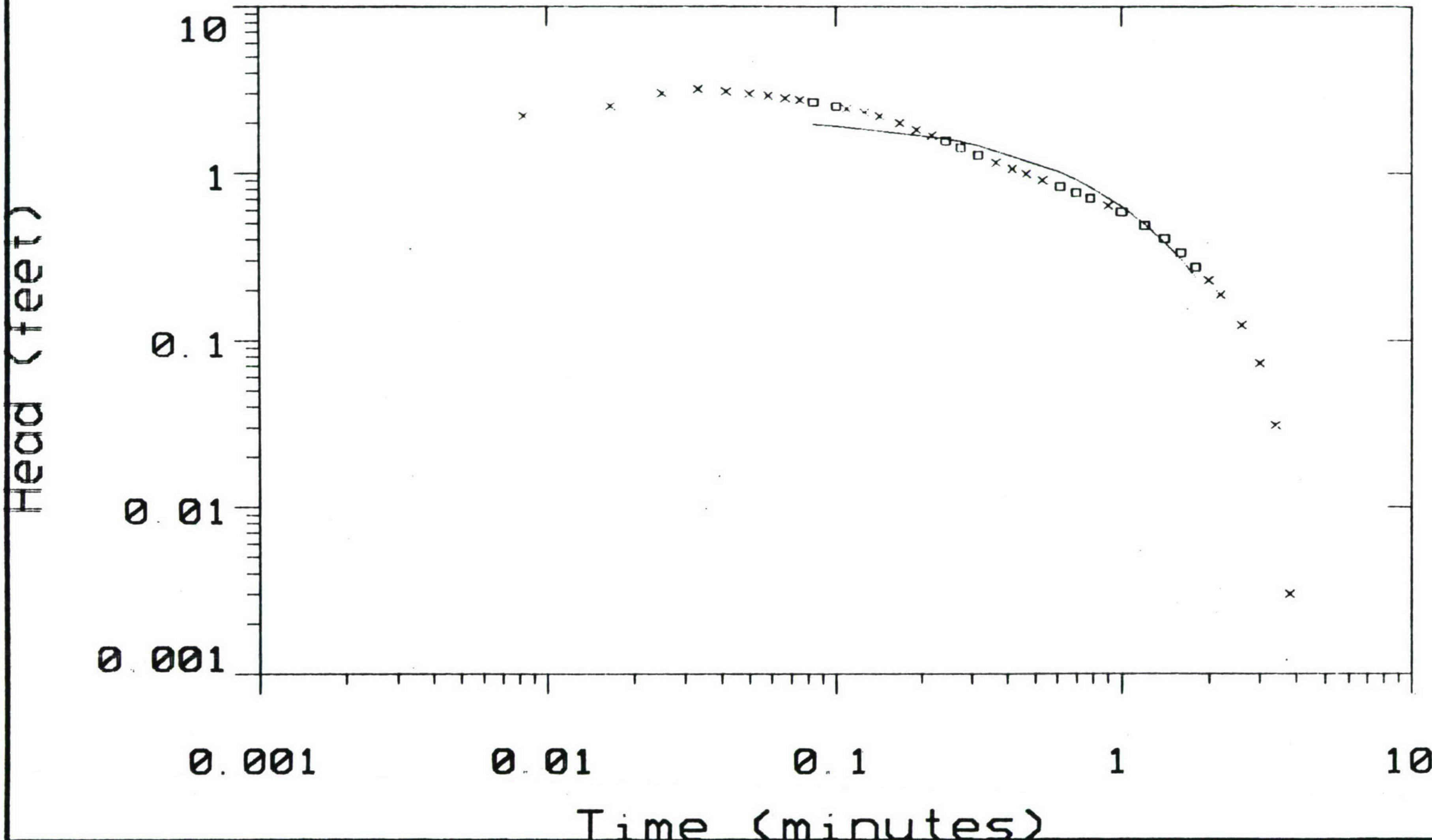
ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P13-M04X

Reference	0.000	Scale Factor	10.051
SG	1.000	Offset	-0.010
Linearity	0.004	Delay mSEC	50.000
Time	20:05	Date	09/23 /93
Logger Test	2	INPUT 1 Level	(F)

Step 1 09/23 10:32:39

Elapsed Time	INPUT 1
0.9666	-0.603
0.9833	-0.593
1.0000	-0.584
1.2000	-0.485
1.4000	-0.403
1.6000	-0.333
1.8000	-0.273
2.0000	-0.228
2.2000	-0.187
2.4000	-0.152
2.6000	-0.123
2.8000	-0.098
3.0000	-0.073
3.2000	-0.053
3.4000	-0.031
3.6000	-0.015
3.8000	-0.003
4.0000	0.009
4.2000	0.012
4.4000	0.019
4.6000	0.025
4.8000	0.028
5.0000	0.034
5.2000	0.038
5.4000	0.044
5.6000	0.047
5.8000	0.047
6.0000	0.050
6.2000	0.050
6.4000	0.053
6.6000	0.053
6.8000	0.053
7.0000	0.057
7.2000	0.057
7.4000	0.060
7.6000	0.060
7.8000	0.060
8.0000	0.060
8.2000	0.060

Elapsed Time	INPUT 1
8.4000	0.060
8.6000	0.063
8.8000	0.060
9.0000	0.063
9.2000	0.060
9.4000	0.063
9.6000	0.063
9.8000	0.063
10.0000	0.063
12.0000	0.063
14.0000	0.066
16.0000	0.060
18.0000	0.057



MODEL TYPE: BOUWER and RICE	
CONDUCTIVITY: .005143 ft/min	
TRANSMISSIVITY: .05878 sq. ft/min	
INITIAL HEAD: 2.196 ft	
Data Set: F13M4S1	Date: 9-23-93

for: **USAEC**
by: Ecology & Environment

WELL DATA: Units: ft
AQUIFER: Endless
THICKNESS: 11.43
SCREEN: top 8.600 base 18.60
DIAMETER: casing .3400 intake .3400
DEPTH: Water Table 8.730 TD: 20.16

Well Slug Test Data

Well: E3-P13-M04

SUDBURY, MA
SUDBURY

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P36-M01X

Reference	0.000	Scale Factor	10.051
SG	1.000	Offset	-0.010
Linearity	0.004	Delay mSEC	50.000
Time	20:12	Date	09/21 /93
Logger Test	4	INPUT 1 Level	(F)

Step 1 09/21 14:46:43

Elapsed Time	INPUT 1	Elapsed Time	INPUT 1
0.0000	-0.802	0.3250	-0.304
0.0083	-0.717	0.3333	-0.301
0.0166	-0.650	0.3500	-0.301
0.0250	-0.590	0.3666	-0.298
0.0333	-0.539	0.3833	-0.295
0.0416	-0.507	0.4000	-0.291
0.0500	-0.479	0.4166	-0.291
0.0583	-0.453	0.4333	-0.288
0.0666	-0.431	0.4500	-0.285
0.0750	-0.418	0.4666	-0.285
0.0833	-0.399	0.4833	-0.282
0.0916	-0.393	0.5000	-0.282
0.1000	-0.387	0.5166	-0.279
0.1083	-0.377	0.5333	-0.279
0.1166	-0.374	0.5500	-0.276
0.1250	-0.371	0.5666	-0.276
0.1333	-0.364	0.5833	-0.272
0.1416	-0.358	0.6000	-0.272
0.1500	-0.355	0.6166	-0.269
0.1583	-0.349	0.6333	-0.269
0.1666	-0.345	0.6500	-0.269
0.1750	-0.342	0.6666	-0.266
0.1833	-0.339	0.6833	-0.266
0.1916	-0.336	0.7000	-0.263
0.2000	-0.333	0.7166	-0.263
0.2083	-0.330	0.7333	-0.263
0.2166	-0.326	0.7500	-0.260
0.2250	-0.326	0.7666	-0.260
0.2333	-0.323	0.7833	-0.260
0.2416	-0.320	0.8000	-0.260
0.2500	-0.320	0.8166	-0.257
0.2583	-0.317	0.8333	-0.257
0.2666	-0.314	0.8500	-0.253
0.2750	-0.314	0.8666	-0.253
0.2833	-0.311	0.8833	-0.253
0.2916	-0.311	0.9000	-0.250
0.3000	-0.307	0.9166	-0.250
0.3083	-0.307	0.9333	-0.250
0.3166	-0.304	0.9500	-0.247

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P36-M01X

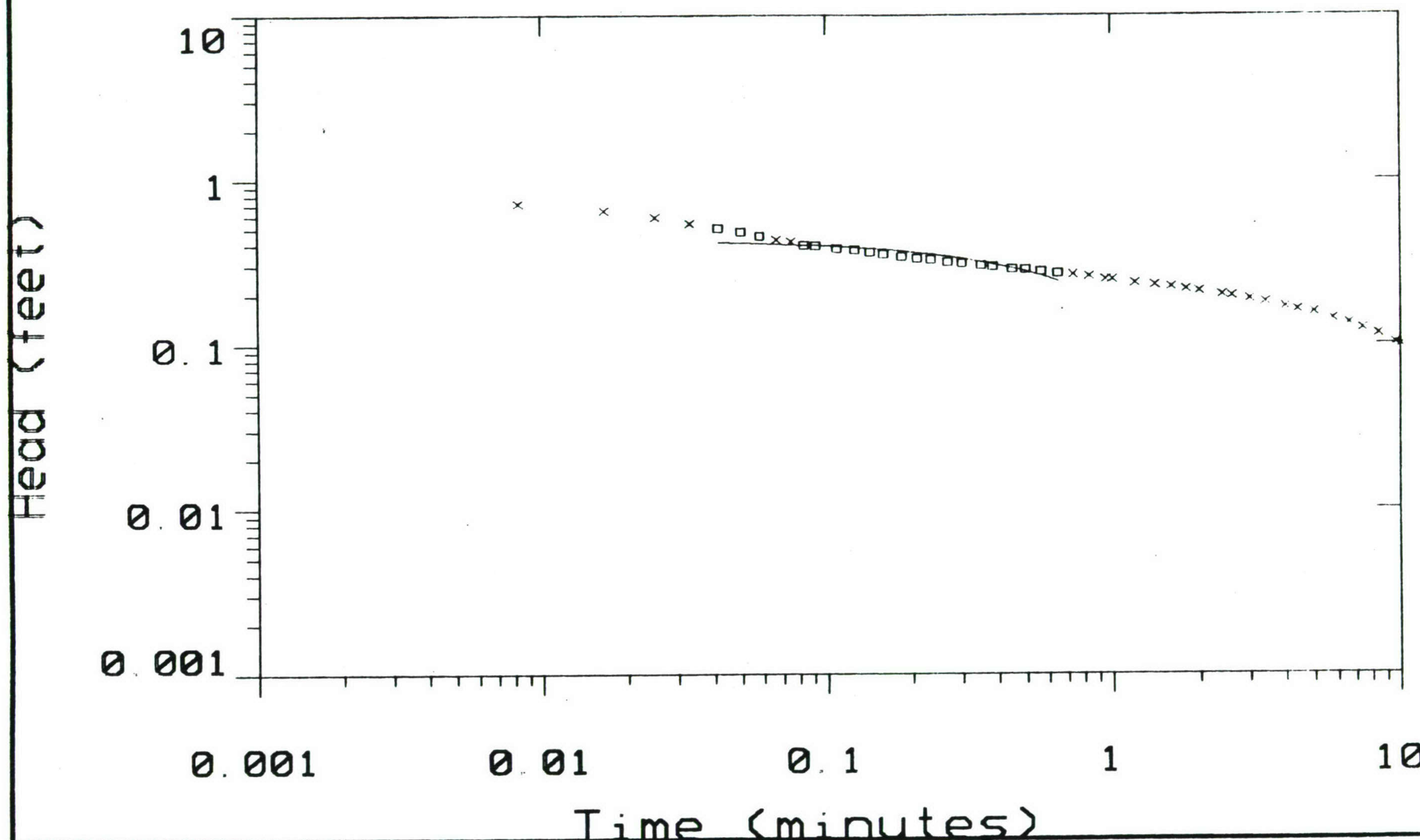
Reference	0.000
SG	1.000
Linearity	0.004
Time	20:12
Logger Test	4

Scale Factor	10.051
Offset	-0.010
Delay mSEC	50.000
Date	09/21 /93
INPUT 1	Level (F)

Step 1 09/21 14:46:43

Elapsed Time	INPUT 1
0.9666	-0.247
0.9833	-0.247
1.0000	-0.247
1.2000	-0.234
1.4000	-0.228
1.6000	-0.222
1.8000	-0.215
2.0000	-0.209
2.2000	-0.206
2.4000	-0.199
2.6000	-0.196
2.8000	-0.190
3.0000	-0.187
3.2000	-0.184
3.4000	-0.180
3.6000	-0.174
3.8000	-0.171
4.0000	-0.168
4.2000	-0.165
4.4000	-0.161
4.6000	-0.158
4.8000	-0.155
5.0000	-0.155
5.2000	-0.149
5.4000	-0.149
5.6000	-0.145
5.8000	-0.142
6.0000	-0.139
6.2000	-0.136
6.4000	-0.133
6.6000	-0.133
6.8000	-0.130
7.0000	-0.126
7.2000	-0.126
7.4000	-0.123
7.6000	-0.120
7.8000	-0.120
8.0000	-0.117
8.2000	-0.114

Elapsed Time	INPUT 1
8.4000	-0.114
8.6000	-0.111
8.8000	-0.111
9.0000	-0.107
9.2000	-0.104
9.4000	-0.104
9.6000	-0.101
9.8000	-0.101
10.0000	-0.098
12.0000	-0.085
14.0000	-0.072
16.0000	-0.060



MODEL TYPE: BOUWER and RICE

CONDUCTIVITY: 003472 ft/min

TRANSMISSIVITY: 008646 sq ft/min

INITIAL HEAD: 7170 ft

Data Set: F36M1S1 | Date: 9-21-93

for: USAEC

by: Ecology & Environment

WELL DATA: Units: ft

AQUIFER: Endless

THICKNESS: 2 490

SCREEN: top: 8 000 base: 18 00

DIAMETER: casing: 3400 intake: 3400

DEPTH: Water Table: 17 01 TD: 19 50

Well Slug Test Data

Well: E3-P36-M01

SUDBURY, MA

SUDBURY

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P36-M02X

Reference	0.000
SG	1.000
Linearity	0.004
Time	20:21
Logger Test	3

Scale Factor	10.051
Offset	-0.010
Delay mSEC	50.000
Date	09/21 /93
INPUT 1 Level	(F)

Step 1 09/21 13:42:03

Elapsed Time	INPUT 1
0.0000	-0.180
0.0083	-0.165
0.0166	-0.149
0.0250	-0.142
0.0333	-0.136
0.0416	-0.133
0.0500	-0.130
0.0583	-0.126
0.0666	-0.123
0.0750	-0.123
0.0833	-0.120
0.0916	-0.114
0.1000	-0.120
0.1083	-0.114
0.1166	-0.117
0.1250	-0.114
0.1333	-0.114
0.1416	-0.114
0.1500	-0.114
0.1583	-0.111
0.1666	-0.111
0.1750	-0.111
0.1833	-0.111
0.1916	-0.111
0.2000	-0.107
0.2083	-0.107
0.2166	-0.107
0.2250	-0.107
0.2333	-0.107
0.2416	-0.107
0.2500	-0.107
0.2583	-0.104
0.2666	-0.104
0.2750	-0.107
0.2833	-0.104
0.2916	-0.104
0.3000	-0.104
0.3083	-0.104
0.3166	-0.104

Elapsed Time	INPUT 1
0.3250	-0.104
0.3333	-0.104
0.3500	-0.104
0.3666	-0.101
0.3833	-0.101
0.4000	-0.104
0.4166	-0.101
0.4333	-0.101
0.4500	-0.101
0.4666	-0.101
0.4833	-0.101
0.5000	-0.101
0.5166	-0.101
0.5333	-0.101
0.5500	-0.101
0.5666	-0.101
0.5833	-0.098
0.6000	-0.098
0.6166	-0.098
0.6333	-0.098
0.6500	-0.098
0.6666	-0.098
0.6833	-0.098
0.7000	-0.098
0.7166	-0.098
0.7333	-0.098
0.7500	-0.098
0.7666	-0.098
0.7833	-0.098
0.8000	-0.095
0.8166	-0.095
0.8333	-0.095
0.8500	-0.095
0.8666	-0.095
0.8833	-0.095
0.9000	-0.095
0.9166	-0.095
0.9333	-0.095
0.9500	-0.095

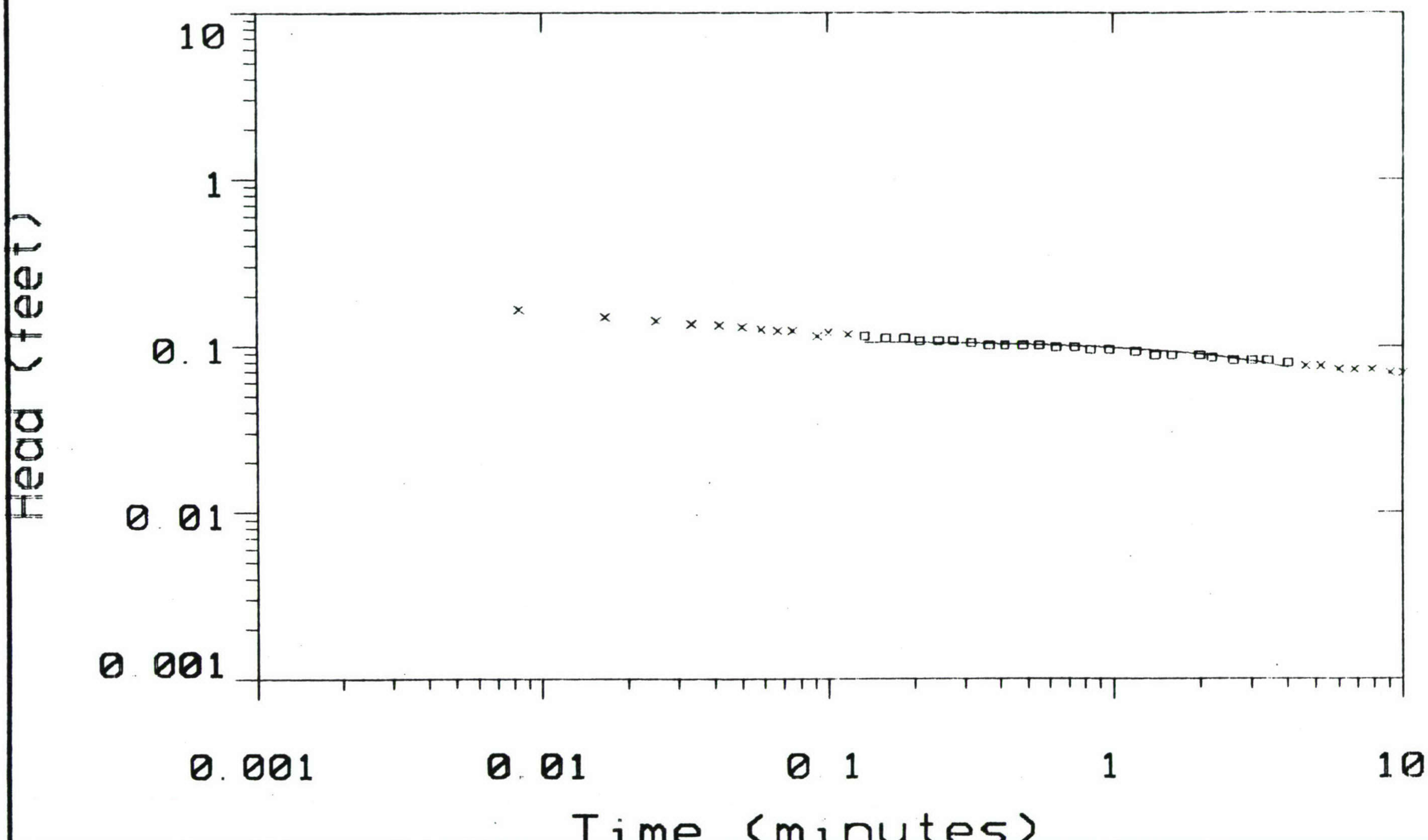
ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P36-M02X

Reference	0.000	Scale Factor	10.051
SG	1.000	Offset	-0.010
Linearity	0.004	Delay mSEC	50.000
Time	20:21	Date	09/21 /93
Logger Test	3	INPUT 1 Level (F)	

Step 1 09/21 13:42:03

Elapsed Time	INPUT 1
0.9666	-0.095
0.9833	-0.095
1.0000	-0.095
1.2000	-0.092
1.4000	-0.088
1.6000	-0.088
1.8000	-0.088
2.0000	-0.088
2.2000	-0.085
2.4000	-0.082
2.6000	-0.082
2.8000	-0.082
3.0000	-0.082
3.2000	-0.082
3.4000	-0.082
3.6000	-0.082
3.8000	-0.079
4.0000	-0.079
4.2000	-0.079
4.4000	-0.079
4.6000	-0.076
4.8000	-0.076
5.0000	-0.076
5.2000	-0.076
5.4000	-0.076
5.6000	-0.076
5.8000	-0.076
6.0000	-0.072
6.2000	-0.072
6.4000	-0.076
6.6000	-0.072
6.8000	-0.072
7.0000	-0.072
7.2000	-0.072
7.4000	-0.072
7.6000	-0.072
7.8000	-0.072
8.0000	-0.072
8.2000	-0.072

Elapsed Time	INPUT 1
8.4000	-0.072
8.6000	-0.072
8.8000	-0.069
9.0000	-0.069
9.2000	-0.069
9.4000	-0.069
9.6000	-0.069
9.8000	-0.069
10.0000	-0.069
12.0000	-0.066
14.0000	-0.063
16.0000	-0.060
18.0000	-0.060
20.0000	-0.057
22.0000	-0.053
24.0000	-0.050
26.0000	-0.047
28.0000	-0.050
30.0000	-0.047
32.0000	-0.044



MODEL TYPE: BOUWER and RICE

CONDUCTIVITY: 0005793 ft/min

TRANSMISSIVITY: 003012 sq. ft/min

INITIAL HEAD: 1650 ft

Data Set: F36M2S1 | Date: 9-21-93

for: USAEC

by: Ecology & Environment

WELL DATA: Units: ft

AQUIFER: Endless

THICKNESS: 5 200

SCREEN: top 8.000 base 18 00

DIAMETER: casing 3400 intake 3400

DEPTH: Water Table: 15 60 TD: 20 80

Well Slug Test Data

Well: E3-P36-M02

SUDBURY, MA

SUDBURY

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P36-M03X

Reference	0.000
SG	1.000
Linearity	-0.000
Time	20:26
Logger Test	3

Scale Factor	9.990
Offset	-0.009
Delay mSEC	50.000
Date	09/21 /93
INPUT 2	Level (F)

Step 1 09/21 13:42:03

Elapsed Time	INPUT 2
0.0000	-1.207
0.0083	-1.160
0.0166	-1.110
0.0250	-1.059
0.0333	-1.002
0.0416	-0.965
0.0500	-0.930
0.0583	-0.889
0.0666	-0.857
0.0750	-0.823
0.0833	-0.797
0.0916	-0.766
0.1000	-0.747
0.1083	-0.722
0.1166	-0.706
0.1250	-0.690
0.1333	-0.678
0.1416	-0.665
0.1500	-0.656
0.1583	-0.649
0.1666	-0.640
0.1750	-0.633
0.1833	-0.630
0.1916	-0.624
0.2000	-0.621
0.2083	-0.615
0.2166	-0.611
0.2250	-0.608
0.2333	-0.605
0.2416	-0.599
0.2500	-0.592
0.2583	-0.589
0.2666	-0.586
0.2750	-0.583
0.2833	-0.580
0.2916	-0.580
0.3000	-0.577
0.3083	-0.574
0.3166	-0.570

Elapsed Time	INPUT 2
0.3250	-0.570
0.3333	-0.567
0.3500	-0.564
0.3666	-0.561
0.3833	-0.558
0.4000	-0.555
0.4166	-0.551
0.4333	-0.548
0.4500	-0.545
0.4666	-0.542
0.4833	-0.539
0.5000	-0.536
0.5166	-0.533
0.5333	-0.529
0.5500	-0.529
0.5666	-0.526
0.5833	-0.523
0.6000	-0.520
0.6166	-0.517
0.6333	-0.514
0.6500	-0.514
0.6666	-0.510
0.6833	-0.507
0.7000	-0.504
0.7166	-0.504
0.7333	-0.501
0.7500	-0.498
0.7666	-0.495
0.7833	-0.495
0.8000	-0.492
0.8166	-0.488
0.8333	-0.485
0.8500	-0.485
0.8666	-0.482
0.8833	-0.479
0.9000	-0.479
0.9166	-0.476
0.9333	-0.473
0.9500	-0.473

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P36-M03X

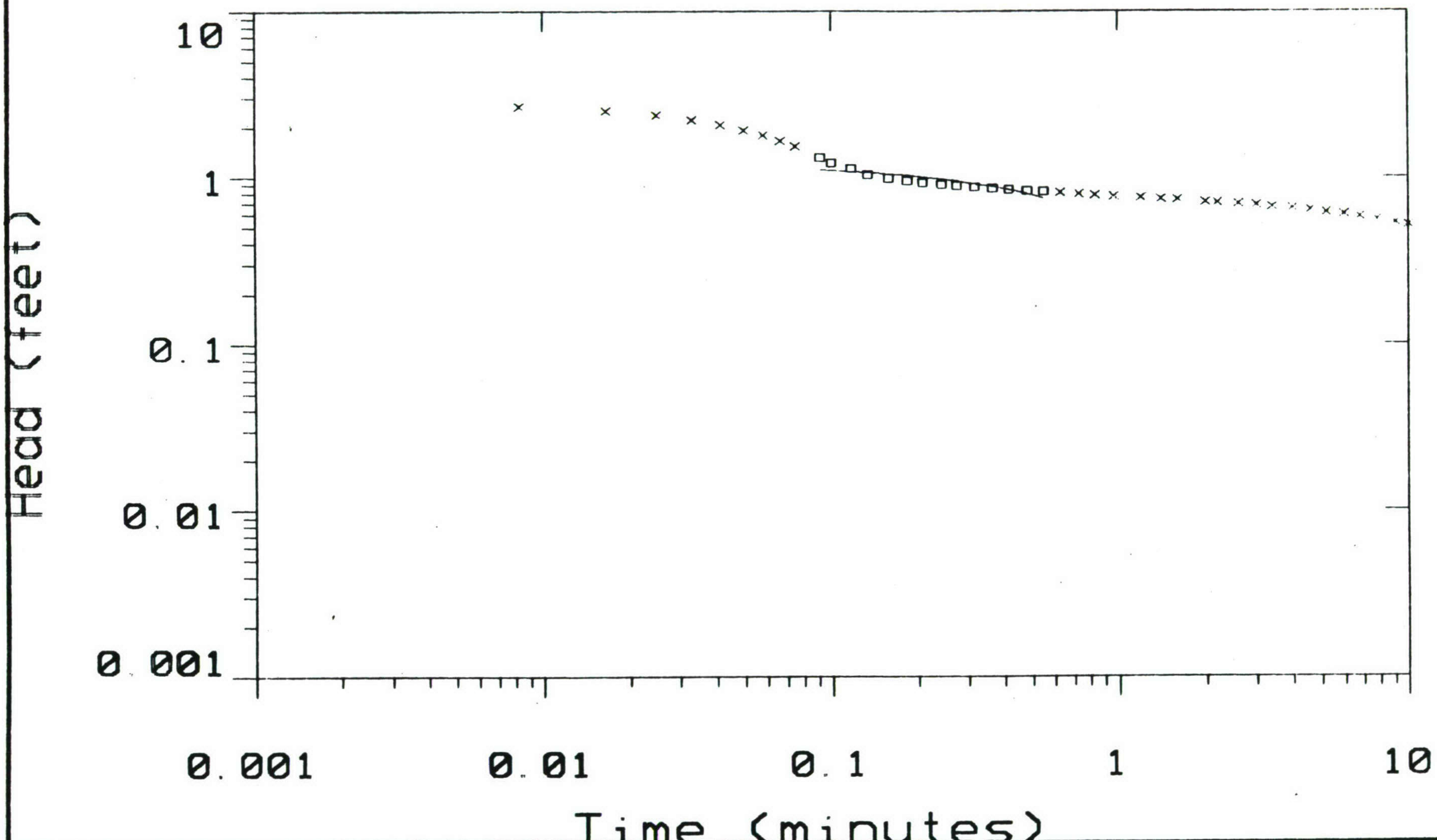
Reference	0.000
SG	1.000
Linearity	-0.000
Time	20:26
Logger Test	3

Scale Factor	9.990
Offset	-0.009
Delay mSEC	50.000
Date	09/21 /93
INPUT 2 Level (F)	

Step 1 09/21 13:42:03

Elapsed Time	INPUT 2
0.9666	-0.469
0.9833	-0.466
1.0000	-0.466
1.2000	-0.441
1.4000	-0.422
1.6000	-0.403
1.8000	-0.384
2.0000	-0.365
2.2000	-0.350
2.4000	-0.334
2.6000	-0.318
2.8000	-0.305
3.0000	-0.290
3.2000	-0.277
3.4000	-0.264
3.6000	-0.252
3.8000	-0.239
4.0000	-0.227
4.2000	-0.214
4.4000	-0.201
4.6000	-0.189
4.8000	-0.176
5.0000	-0.164
5.2000	-0.148
5.4000	-0.126
5.6000	-0.110
5.8000	-0.094
6.0000	-0.078
6.2000	-0.069
6.4000	-0.056
6.6000	-0.050
6.8000	-0.044
7.0000	-0.037
7.2000	-0.031
7.4000	-0.028
7.6000	-0.025
7.8000	-0.022
8.0000	-0.022
8.2000	-0.018

Elapsed Time	INPUT 2
8.4000	-0.015
8.6000	-0.015
8.8000	-0.015
9.0000	-0.015
9.2000	-0.012
9.4000	-0.012
9.6000	-0.012
9.8000	-0.012
10.0000	-0.009
12.0000	-0.006
14.0000	-0.006
16.0000	-0.003
18.0000	-0.003
20.0000	-0.003
22.0000	0.000
24.0000	0.000
26.0000	0.000
28.0000	-0.003
30.0000	-0.003
32.0000	-0.003



MODEL TYPE: BOUWER and RICE	
CONDUCTIVITY: .006670 ft/min	
TRANSMISSIVITY: .03001 sq. ft/min	
INITIAL HEAD: 2.681 ft	
Data Set: P36M3S1	Date: 9-21-93

for: **USAEC**

by: Ecology & Environment

WELL DATA: Units: ft
AQUIFER: Endless
THICKNESS: 4.500
SCREEN: top 9.000 base 19.00
DIAMETER: casing: .3400 intake: .3400
DEPTH: Water Table: 16.68 TD: 21.18

Well Slug Test Data

Well: E3-P36-M03

SUDBURY, MA

SUDBURY

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P37-M01X

Reference	0.000	Scale Factor	10.012
SG	1.000	Offset	-0.042
Linearity	0.009	Delay mSEC	50.000
Time	20:30	Date	09/21 /93
Logger Test	3	INPUT 3 Level	(F)

Step 1 09/21 13:42:03

Elapsed Time	INPUT 3	Elapsed Time	INPUT 3
0.0000	2.830	0.3250	0.869
0.0083	2.681	0.3333	0.866
0.0166	2.514	0.3500	0.863
0.0250	2.365	0.3666	0.857
0.0333	2.223	0.3833	0.853
0.0416	2.065	0.4000	0.847
0.0500	1.919	0.4166	0.844
0.0583	1.783	0.4333	0.841
0.0666	1.653	0.4500	0.838
0.0750	1.533	0.4666	0.834
0.0833	1.413	0.4833	0.831
0.0916	1.315	0.5000	0.825
0.1000	1.223	0.5166	0.822
0.1083	1.170	0.5333	0.822
0.1166	1.125	0.5500	0.819
0.1250	1.072	0.5666	0.815
0.1333	1.037	0.5833	0.812
0.1416	1.015	0.6000	0.809
0.1500	0.996	0.6166	0.809
0.1583	0.980	0.6333	0.806
0.1666	0.967	0.6500	0.803
0.1750	0.958	0.6666	0.803
0.1833	0.948	0.6833	0.800
0.1916	0.942	0.7000	0.796
0.2000	0.936	0.7166	0.796
0.2083	0.929	0.7333	0.793
0.2166	0.923	0.7500	0.793
0.2250	0.917	0.7666	0.790
0.2333	0.913	0.7833	0.790
0.2416	0.907	0.8000	0.787
0.2500	0.904	0.8166	0.784
0.2583	0.898	0.8333	0.784
0.2666	0.894	0.8500	0.781
0.2750	0.891	0.8666	0.781
0.2833	0.888	0.8833	0.777
0.2916	0.882	0.9000	0.777
0.3000	0.879	0.9166	0.777
0.3083	0.876	0.9333	0.774
0.3166	0.872	0.9500	0.774

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P37-M01X

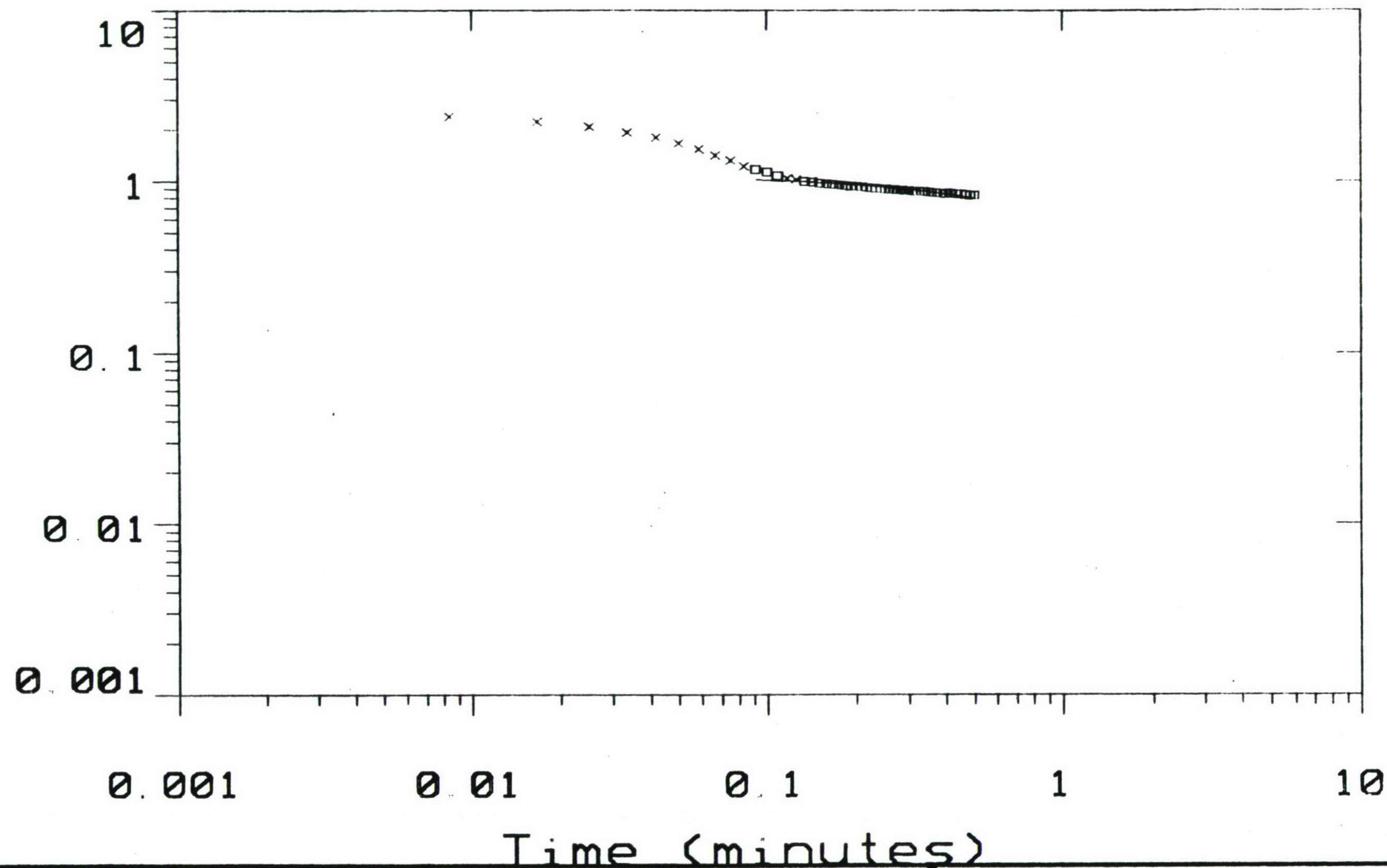
Reference	0.000
SG	1.000
Linearity	0.009
Time	20:30
Logger Test	3

Scale Factor	10.012
Offset	-0.042
Delay mSEC	50.000
Date	09/21 /93
INPUT 3 Level (F)	

Step 1 09/21 13:42:03

Elapsed Time	INPUT 3
0.9666	0.771
0.9833	0.771
1.0000	0.771
1.2000	0.755
1.4000	0.743
1.6000	0.733
1.8000	0.724
2.0000	0.714
2.2000	0.708
2.4000	0.702
2.6000	0.695
2.8000	0.686
3.0000	0.679
3.2000	0.673
3.4000	0.667
3.6000	0.660
3.8000	0.657
4.0000	0.651
4.2000	0.645
4.4000	0.638
4.6000	0.635
4.8000	0.629
5.0000	0.623
5.2000	0.616
5.4000	0.613
5.6000	0.607
5.8000	0.604
6.0000	0.597
6.2000	0.594
6.4000	0.588
6.6000	0.585
6.8000	0.578
7.0000	0.575
7.2000	0.569
7.4000	0.566
7.6000	0.562
7.8000	0.556
8.0000	0.553
8.2000	0.550

Elapsed Time	INPUT 3
8.4000	0.543
8.6000	0.540
8.8000	0.537
9.0000	0.534
9.2000	0.528
9.4000	0.524
9.6000	0.521
9.8000	0.518
10.0000	0.515
12.0000	0.483
14.0000	0.452
16.0000	0.426
18.0000	0.398
20.0000	0.376
22.0000	0.351
24.0000	0.328
26.0000	0.309
28.0000	0.290
30.0000	0.271
32.0000	0.253



MODEL TYPE: BOUWER and RICE		for: USAEC	Well Slug Test Data
CONDUCTIVITY: .008096 ft/min		by: Ecology & Environment	Well: E3-P37-M01
TRANSMISSIVITY: .05821 sq. ft/min		WELL DATA: Units: ft	SUDBURY, MA
INITIAL HEAD: 2.365 ft		AQUIFER: Endless	SUDBURY
Data Set: F37M1S1	Date: 9-21-93	THICKNESS: 7.190	
		SCREEN: top: 9.500 base: 19.50	
		DIAMETER: casing: .3400 intake: .3400	
		DEPTH: Water Table: 13.95 TD: 21.14	

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P37-M02X

Reference	0.000
SG	1.000
Linearity	0.004
Time	21:11
Logger Test	2

Scale Factor	10.051
Offset	-0.010
Delay mSEC	50.000
Date	09/21 /93
INPUT 1 Level	(F)

Step 1 09/21 11:43:24

Elapsed Time	INPUT 1
0.0000	-0.380
0.0083	-0.371
0.0166	-0.368
0.0250	-0.368
0.0333	-0.371
0.0416	-0.371
0.0500	-0.371
0.0583	-0.384
0.0666	-0.393
0.0750	-0.387
0.0833	-0.377
0.0916	-0.374
0.1000	-0.371
0.1083	-0.371
0.1166	-0.371
0.1250	-0.371
0.1333	-0.371
0.1416	-0.368
0.1500	-0.368
0.1583	-0.368
0.1666	-0.364
0.1750	-0.364
0.1833	-0.364
0.1916	-0.364
0.2000	-0.361
0.2083	-0.361
0.2166	-0.361
0.2250	-0.361
0.2333	-0.358
0.2416	-0.358
0.2500	-0.355
0.2583	-0.355
0.2666	-0.355
0.2750	-0.352
0.2833	-0.355
0.2916	-0.352
0.3000	-0.352
0.3083	-0.352
0.3166	-0.349

Elapsed Time	INPUT 1
0.3250	-0.349
0.3333	-0.349
0.3500	-0.345
0.3666	-0.345
0.3833	-0.342
0.4000	-0.339
0.4166	-0.339
0.4333	-0.336
0.4500	-0.336
0.4666	-0.333
0.4833	-0.333
0.5000	-0.330
0.5166	-0.330
0.5333	-0.326
0.5500	-0.326
0.5666	-0.323
0.5833	-0.323
0.6000	-0.320
0.6166	-0.320
0.6333	-0.317
0.6500	-0.317
0.6666	-0.314
0.6833	-0.314
0.7000	-0.311
0.7166	-0.311
0.7333	-0.307
0.7500	-0.304
0.7666	-0.304
0.7833	-0.304
0.8000	-0.301
0.8166	-0.301
0.8333	-0.298
0.8500	-0.298
0.8666	-0.295
0.8833	-0.295
0.9000	-0.291
0.9166	-0.291
0.9333	-0.291
0.9500	-0.288

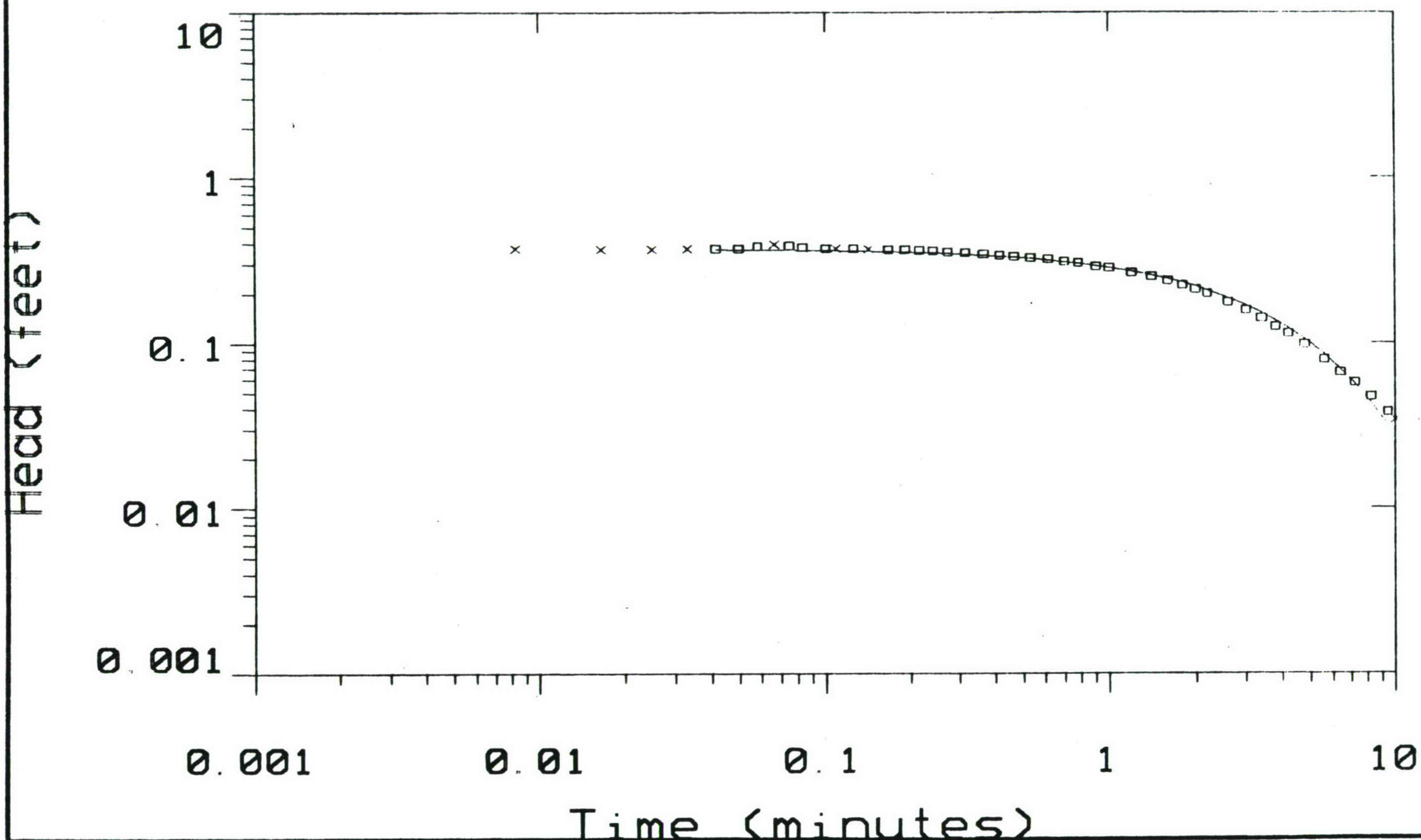
ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P37-M02X

Reference	0.000	Scale Factor	10.051
SG	1.000	Offset	-0.010
Linearity	0.004	Delay mSEC	50.000
Time	21:11	Date	09/21 /93
Logger Test	2	INPUT 1 Level	(F)

Step 1 09/21 11:43:24

Elapsed Time	INPUT 1
0.9666	-0.288
0.9833	-0.285
1.0000	-0.285
1.2000	-0.266
1.4000	-0.253
1.6000	-0.238
1.8000	-0.225
2.0000	-0.212
2.2000	-0.199
2.4000	-0.187
2.6000	-0.177
2.8000	-0.168
3.0000	-0.158
3.2000	-0.149
3.4000	-0.142
3.6000	-0.133
3.8000	-0.126
4.0000	-0.120
4.2000	-0.114
4.4000	-0.107
4.6000	-0.104
4.8000	-0.098
5.0000	-0.095
5.2000	-0.088
5.4000	-0.085
5.6000	-0.079
5.8000	-0.076
6.0000	-0.072
6.2000	-0.069
6.4000	-0.066
6.6000	-0.063
6.8000	-0.060
7.0000	-0.060
7.2000	-0.057
7.4000	-0.053
7.6000	-0.053
7.8000	-0.050
8.0000	-0.047
8.2000	-0.047

Elapsed Time	INPUT 1
8.4000	-0.044
8.6000	-0.044
8.8000	-0.041
9.0000	-0.041
9.2000	-0.038
9.4000	-0.038
9.6000	-0.034
9.8000	-0.034
10.0000	-0.034
12.0000	-0.028
14.0000	-0.025
16.0000	-0.022
18.0000	-0.022



MODEL TYPE: BOUWER and RICE	for: USAEC	Well Slug Test Data
CONDUCTIVITY: .0007933 ft/min	by: Ecology & Environment	Well: E3-P37-M02
TRANSMISSIVITY: .003593 sq. ft/min	WELL DATA: Units: ft AQUIFER: Endless THICKNESS: 4.530	SUDBURY, MA
INITIAL HEAD: .3710 ft	SCREEN: top: 9.000 base: 19.00 DIAMETER: casing: .3400 intake: .3400	SUDBURY
Data Set: P37M2S1 — Date: 9-21-93	DEPTH: Water Table: 16.32 TD: 20.85	

ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P37-M03X

Reference	0.000	Scale Factor	9.990
SG	1.000	Offset	-0.009
Linearity	-0.000	Delay mSEC	50.000
Time	21:16	Date	09/21 /93
Logger Test	2	INPUT 2 Level (F)	

Step 1 09/21 11:43:24

Elapsed Time	INPUT 2	Elapsed Time	INPUT 2
0.0000	-0.615	0.3250	-0.154
0.0083	-0.589	0.3333	-0.145
0.0166	-0.564	0.3500	-0.132
0.0250	-0.548	0.3666	-0.116
0.0333	-0.529	0.3833	-0.107
0.0416	-0.517	0.4000	-0.094
0.0500	-0.504	0.4166	-0.088
0.0583	-0.492	0.4333	-0.075
0.0666	-0.479	0.4500	-0.072
0.0750	-0.469	0.4666	-0.063
0.0833	-0.454	0.4833	-0.059
0.0916	-0.447	0.5000	-0.053
0.1000	-0.438	0.5166	-0.047
0.1083	-0.425	0.5333	-0.044
0.1166	-0.416	0.5500	-0.037
0.1250	-0.410	0.5666	-0.034
0.1333	-0.400	0.5833	-0.031
0.1416	-0.391	0.6000	-0.028
0.1500	-0.384	0.6166	-0.028
0.1583	-0.375	0.6333	-0.025
0.1666	-0.365	0.6500	-0.022
0.1750	-0.356	0.6666	-0.022
0.1833	-0.346	0.6833	-0.018
0.1916	-0.337	0.7000	-0.015
0.2000	-0.328	0.7166	-0.015
0.2083	-0.315	0.7333	-0.015
0.2166	-0.302	0.7500	-0.012
0.2250	-0.290	0.7666	-0.012
0.2333	-0.277	0.7833	-0.012
0.2416	-0.261	0.8000	-0.009
0.2500	-0.249	0.8166	-0.009
0.2583	-0.236	0.8333	-0.009
0.2666	-0.223	0.8500	-0.009
0.2750	-0.211	0.8666	-0.006
0.2833	-0.198	0.8833	-0.006
0.2916	-0.189	0.9000	-0.006
0.3000	-0.179	0.9166	-0.006
0.3083	-0.170	0.9333	-0.006
0.3166	-0.160	0.9500	-0.003

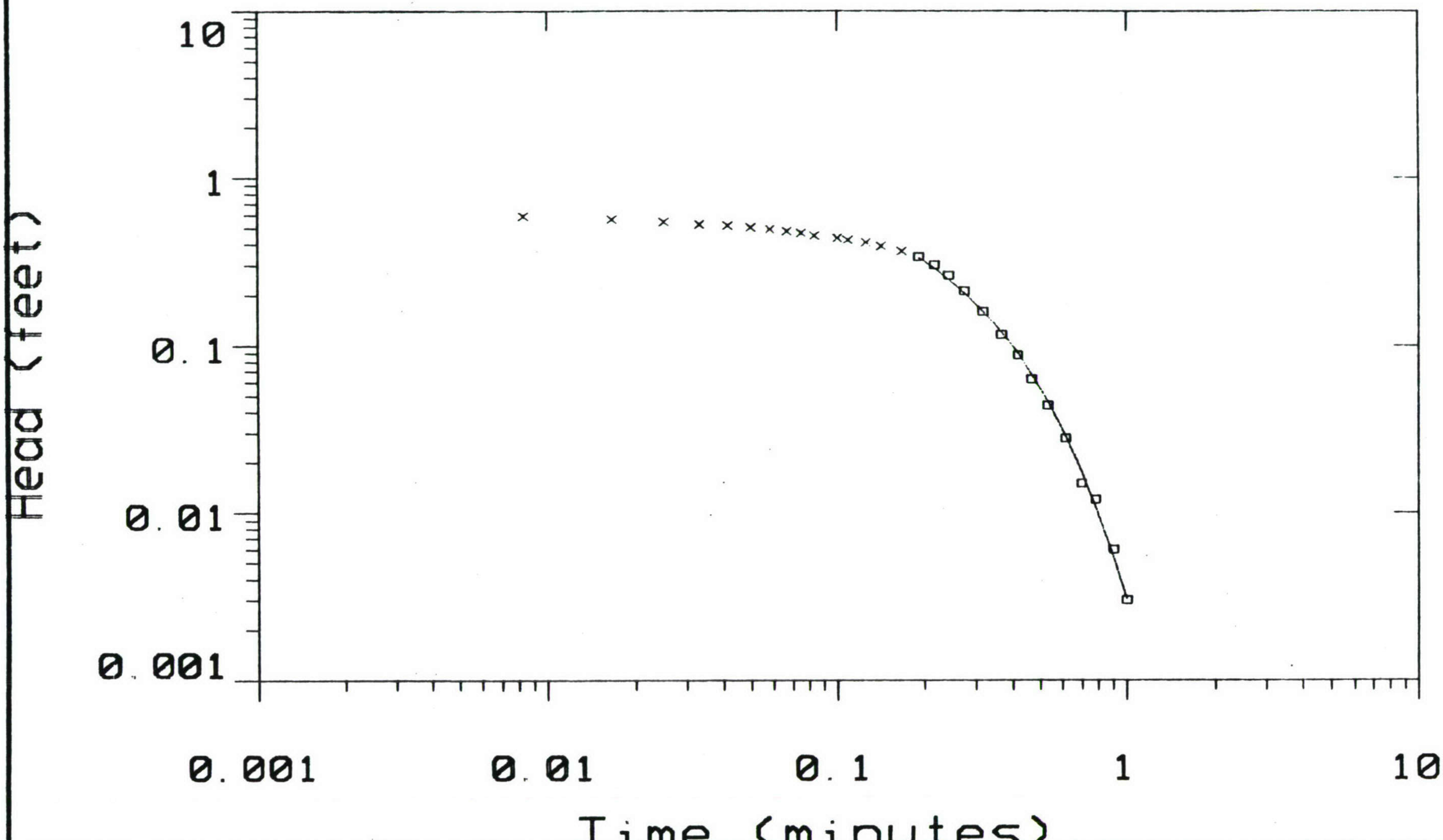
ECOLOGY AND ENVIRONMENT
SE2000
Environmental Logger
Unit# HMC-S
Monitoring Well E3-P37-M03X

Reference	0.000	Scale Factor	9.990
SG	1.000	Offset	-0.009
Linearity	-0.000	Delay mSEC	50.000
Time	21:16	Date	09/21 /93
Logger Test	2	INPUT 2 Level (F)	

Step 1 09/21 11:43:24

Elapsed Time	INPUT 2
0.9666	-0.003
0.9833	-0.003
1.0000	-0.003
1.2000	0.000
1.4000	0.003
1.6000	0.003
1.8000	0.003
2.0000	0.003
2.2000	0.003
2.4000	0.006
2.6000	0.006
2.8000	0.006
3.0000	0.006
3.2000	0.006
3.4000	0.006
3.6000	0.006
3.8000	0.006
4.0000	0.006
4.2000	0.006
4.4000	0.006
4.6000	0.006
4.8000	0.006
5.0000	0.006
5.2000	0.006
5.4000	0.006
5.6000	0.006
5.8000	0.006
6.0000	0.006
6.2000	0.006
6.4000	0.006
6.6000	0.006
6.8000	0.006
7.0000	0.006
7.2000	0.006
7.4000	0.006
7.6000	0.006
7.8000	0.006
8.0000	0.006
8.2000	0.006

Elapsed Time	INPUT 2
8.4000	0.006
8.6000	0.006
8.8000	0.006
9.0000	0.006
9.2000	0.006
9.4000	0.006
9.6000	0.009
9.8000	0.006
10.0000	0.006
12.0000	0.006
14.0000	0.006
16.0000	0.006
18.0000	0.003



MODEL TYPE: BOUWER and RICE	for: USAEC	Well Slug Test Data
CONDUCTIVITY: .01656 ft/min	by: Ecology & Environment	Well: E3-P37-M03
TRANSMISSIVITY: .08100 sq. ft/min	WELL DATA: Units: ft	SUDBURY, MA
INITIAL HEAD: .5890 ft	AQUIFER: Endless	SUDBURY
Data Set: P37M3S1	THICKNESS: 4.890	
Date: 9-21-93	SCREEN: top: 10.00 base: 20.00	
	DIAMETER: casing: .3400 intake: .3400	
	DEPTH: Water Table: 16.93 TD: 21.82	

H

APPENDIX H

GROUNDWATER MODEL REPORT

GROUNDWATER FLOW MODEL FOR SUDBURY TRAINING ANNEX AND VICINITY, MASSACHUSETTS

Prepared for

Ecology and Environment, Inc.
Lancaster, New York

August 8, 1994

GROUNDWATER FLOW MODEL FOR SUDBURY TRAINING ANNEX AND VICINITY, MASSACHUSETTS

Prepared for

Ecology and Environment, Inc.
Lancaster, New York

Prepared by

HydroGeoLogic, Inc.
Herndon, Virginia

August 8, 1994

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PREFACE

The three-dimensional groundwater flow model of the Sudbury Training Annex (the Annex) was prepared by HydroGeoLogic, Inc., under Subcontract UC-6968 for Ecology and Environment, Inc. (E&E). E&E requested this groundwater model to support environmental investigations being conducted at the Annex for the United States Army Environmental Center under Delivery Order No. 0004 of Contract No. DAAA15-90-D-0012. Information from this groundwater model generally confirms the assessment of Annex-wide groundwater flow described in E&E's Draft Phase II Site Investigations/Remedial Investigations Report.

EXECUTIVE SUMMARY

Fort Devens Sudbury Training Annex is a U.S. Army training and research site in Middlesex County, MA. The objective of this study was to develop a regional three dimensional groundwater model capable of simulating subsurface flow at the annex and vicinity. This work is part of ongoing environmental studies at the site.

The site geology consists of three distinct units; a bedrock unit overlain by a thin layer of glacial till with deposits of glacial outwash on top of the till. The bedrock outcrops at a number of locations at the site. In most places it is covered with glacial deposits varying from less than a foot to over 100 feet in thickness. A bedrock elevation map was constructed for the site based on prior investigative reports and USGS topographic maps.

All three geological units contain groundwater, however, the glacial outwash is the most important source of groundwater in the area. Groundwater in the bedrock unit is stored in openings along joints and cleavage planes of the bedrock formations. However, there are no reports on the presence of faults or other major fracture zones in the bedrock that would enable the formations to produce significant amounts of water. The till is comprised of highly compact and poorly sorted boulders, gravel, sand, silt, and clay. Therefore, it has low permeability which makes it a poor source of groundwater. The outwash contains the largest body of groundwater that is readily available. It overlies the till and is the upper layer of the glacial deposits throughout most of the site. The material in the upper portions of the outwash is primarily made of coarse sand and gravel with relatively high permeability, in contrast to its lower beds which contain finer sand and silt.

The groundwater flow dynamics at the site is hydrogeologically complex but conceptually simple. Water enters the subsurface in the form of precipitation flowing towards drainage areas formed by streams, ponds, and marshes at the site. The modeled domain therefore consists of several watershed regions.

The three-dimensional subsurface flow model developed for the site simulates flow in all three geological units. The USGS software code MODFLOW was utilized for constructing the site model. In order for the model to perform reliably, it was first calibrated with respect to the observed or interpreted water table. The interpreted water table was constructed utilizing information from previous investigative studies and data from monitoring wells and surface water gauges. Initial estimates of the hydrogeologic properties and boundary conditions for the model were obtained after carefully reviewing all available data sources pertinent to the site. Numerous simulations were then performed while adjusting the key aquifer parameters until the simulated water table was deemed to be in good agreement with the interpreted water table. The model was then considered calibrated and a reliable tool for conducting predictive and remedial investigative studies.

The model confirmed the subsurface flow dynamics hypothesized for the site. Flow emanates from the outcrops, traversing all three geological units, prior to discharging into the adjacent surface water bodies. The model delineates in detail all the major and minor watersheds in the area. The only major withdrawal in the area is through pumping surface water from White Pond by the Town of Maynard. The model satisfactorily accounts for the estimated contribution of groundwater towards this withdrawal.

In order to further increase confidence in the model, sensitivity analyses were conducted by varying a number of key input parameters and noting the response of the model to the variations. The calibrated model was found to be strongly sensitive only to the ratio of areal recharge and horizontal hydraulic conductivity in the outwash. Since the calibrated recharge to the model is well documented, the model was considered well calibrated and a reliable tool for both predictive and remedial investigation purposes.

1.0 INTRODUCTION

1.1 OVERVIEW

The Fort Devens Sudbury Training Annex is a U.S. Army training and research site located about 20 miles west of Boston in Middlesex County, Massachusetts (Figure 1.1). The site consists of two separate portions of land which incorporate sections of the towns of Hudson, Marlborough, Maynard, Stow and Sudbury. It lies entirely within the Maynard 7.5 minute United States Geological Survey (USGS) topographic map. The total area of the site is approximately 4.3 square miles. Figure 1.2 illustrates the location of the Annex and adjoining areas. The northern portion of the Annex contains facilities for military training and research, and the southern portion currently contains a small housing area for military personnel.

The primary objective of this study is to develop a groundwater flow model capable of assisting in hydrogeologic investigations for the purpose of studying the long-term cumulative impacts of continuous pumping of water and the migration of potential contaminants in and around the site. This work is part of ongoing environmental studies at the site. The model simulates groundwater flow within three hydrogeological units identified beneath the site area. They are the glacial outwash at the top (the primary source of groundwater), underlain by a thin layer of till, and igneous/metamorphic crystalline bedrock at the bottom. The model accounts for major hydrological processes such as areal recharge, pumping and groundwater discharge to streams and ponds. The model was developed using the USGS numerical modeling code MODFLOW (McDonald and Harbaugh, 1988).

1.2 SCOPE OF WORK

The scope of work for this project consists of the following major tasks:

- Review, compilation, and analysis of existing hydrogeologic data for the region.

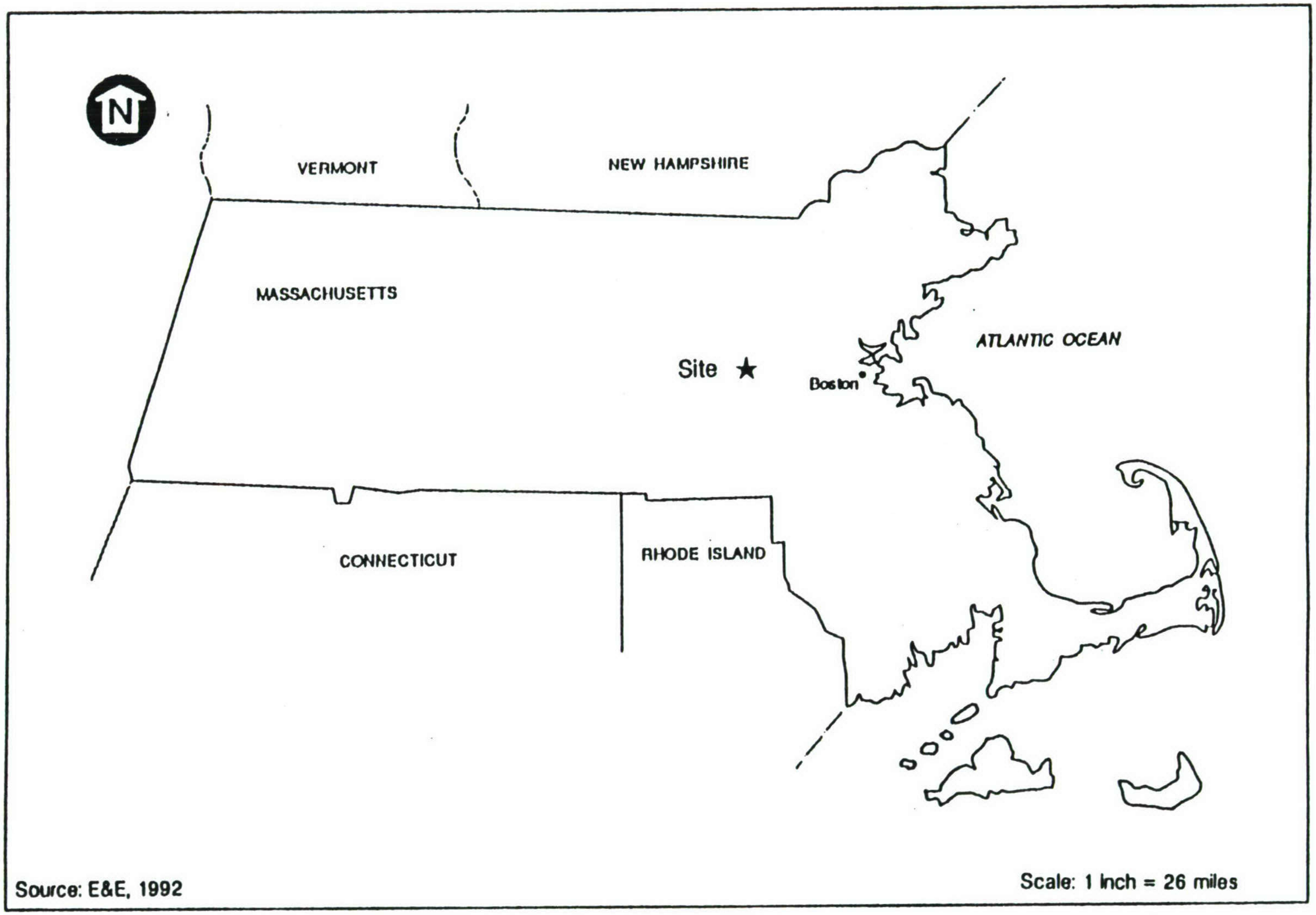

Figure 1.1 Sudbury Annex Location Map.

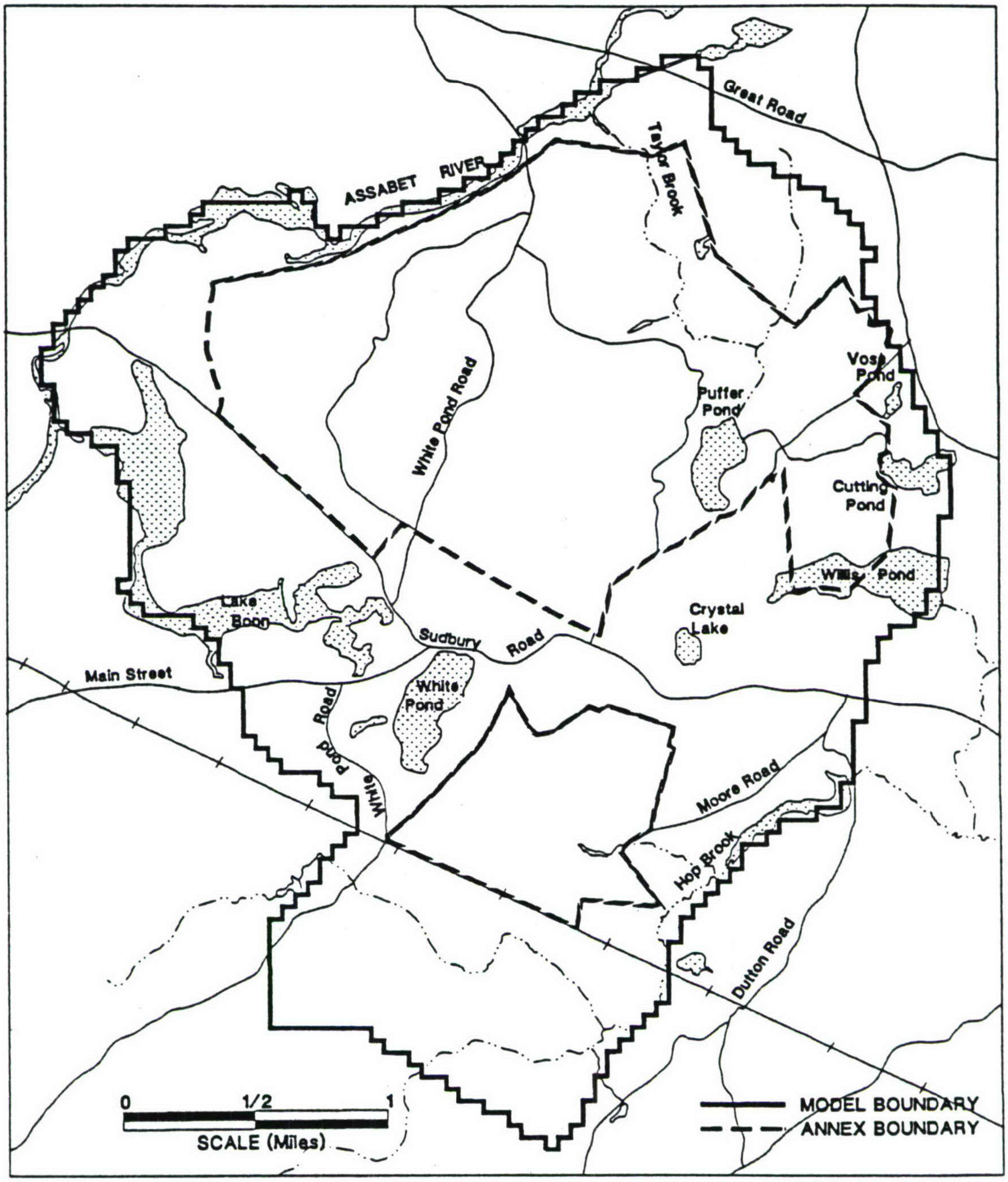

Figure 1.2 Sudbury Annex Site Map.

- Construction of a calibrated three-dimensional groundwater flow model capable of simulating existing and future hydrologic conditions at the site.

- Performing sensitivity studies in order to demonstrate reliability of model, and assist in planning field investigations.

- Documenting data sources and the model development process in a comprehensive report.

1.3 ORGANIZATION OF REPORT

This report is divided into 4 chapters. Chapter 1 describes the project objective. Chapter 2 describes the overall environmental setting. Chapter 3 describes and discusses the construction and calibration of the numerical model, simulated results, and the sensitivity analysis. Chapter 4 consists of a brief summary and conclusions.

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2.0 ENVIRONMENTAL SETTING

2.1 TOPOGRAPHY AND CLIMATE

The site topography is generally flat and is characterized by small scattered hills, ponds and streams. The altitude of the land surface varies from 320 ft above mean sea level (amsl) at the hills in the northern portion of the site to about 150 ft at the stream valley in the southeast portion. The altitude of the flat plains is between 180 to 210 ft. The climate in the area is humid with a mean annual precipitation of about 44 inches per year. Rainfall is generally uniformly distributed throughout the year with monthly averages ranging from 3 to 4 inches. Nearly half of the precipitation is lost to evaporation and transpiration (Perlmutter, 1962).

There are many swamps and undrained depressions in the plain that cause irregular drainage commonly encountered in glaciated regions. Many small streams that drain the area flow north towards the Assabet River, which forms the northern boundary of the study site (see Figure 1.2), or to several ponds and lakes in different parts of the site. The surface water bodies are also discharge points for groundwater, and therefore significantly influence movement of groundwater within the study area. The southeast portion of the site drains to Willis Pond and Hop Brook which are tributaries of the Sudbury River. The Assabet and Sudbury Rivers join northeast of the site to form the Concord River.

2.2 GEOLOGY

The site geology consists of three distinct units; a bedrock unit overlain by a thin layer of glacial till and deposits of glacial outwash on the top. The bedrock under the site consists of Paleozoic age igneous and metamorphic rocks. Hansen (1956) investigated the geologic history of the site area and mapped five distinct geologic units. From oldest to youngest, they are: i) the Marlboro formation (schist), which lies underneath a long narrow strip that extends from the southern border of the study site through White Pond, Puffer Pond and Vose Hill; ii) gabbro-

diorite, which occupies the Willis Pond and vicinity; iii) the Dedham granodiorite, which lies underneath the southeastern section of the site; iv) the Nashoba formation (gneiss), which underlies the northwestern corner of the site; and v) the Gospel Hill gneiss, which occupies the area under the center of the Armex, between the Nashoba and Marlboro formations.

Perlmutter (1962) provided a detailed description of the site geologic history as follows:

> "The sediments that formed the oldest bedrock unit, the Marlboro formation, were deposited in Precambrian time and consisted of sand, silt, clay and perhaps some volcanic material. Sometime during Precambrian, these sediments were metamorphosed into schistose rocks. Later, in early Paleozoic time, these rocks were intruded by large bodies of igneous material, which upon cooling formed the Salem(?) gabbro-diorite and the Dedham granodiorite. During Carboniferous time, sediments were deposited on the surface of the older rocks and at the close of the period all the rocks were uplifted, folded and metamorphosed, and schistose and gneiss rocks of the Nashoba formation and Gospel Hill gneiss were formed.
>
> The uplift in late Carboniferous time was followed by predominantly erosional periods and by early Cretaceous time the land surface had been reduced to peneplain. During the Tertiary age, renewed uplift and extensive erosion occurred. The first major streams developed on the newly uplifted surface were of the consequent type and generally ignored the structure of the bedrock, but many tributary streams developed following the northeastward-trending belts of relatively soft rock and thus developed a regional trellis drainage pattern. Dissection of the Cretaceous peneplain was completed by late Pliocene time, and an irregular bedrock surface was exposed to ice sheets during the subsequent Pleistocene epoch."

The bedrock outcrops at a number of locations at the site. In most places it is covered with glacial deposits varying from less than a foot to over 100 feet in thickness. Two seismic surveys were carried out at the site by the USGS (Perlmutter, 1962), and by the DuFrense-Henry (1982) to obtain information on the surface configuration of the bedrock unit. The USGS study covered the southern part of the site; specifically the area east of White Pond and west of Hop Brook. The second study was limited to a relatively small area near Tuttle Hill and along Taylor Brook. Both studies were part of groundwater supply investigations conducted in the area, and were accompanied by the drilling of boreholes to the bedrock. Both studies reported that the bedrock

surface elevation is highly irregular with depths ranging from less than a foot to more than 100 ft below land surface.

A bedrock elevation map (Figure 2.1) was constructed for the site based on information contained in the above mentioned studies. Bedrock elevation in the southern part of the Annex was mapped by Perlmutter (1962). DuFrense-Henry (1982) generated limited bedrock data from a seismic study which included borehole drilling carried out near the Tuttle Hill area. Bedrock elevations in areas where data was not available or insufficient has been estimated by extrapolating trends from data in the investigative studies. Specifically, it was noted that the depth to bedrock surface varies from a maximum of 90 ft below the surface, mainly in the valleys, to a minimum of zero in areas where the bedrock is exposed.

The glacial till which overlies the bedrock is an unstratified and irregular layer that consists of poorly sorted boulders, gravel, sand, silt and clay. Perlmutter (1962) described this unit as discontinuous patches of different thickness in areas where the bedrock surface is at shallow depths, and as thick elongated bodies in the form of drumlins bordered by outwash in places where the bedrock surface is deeper. The thickness of the till has been reported to vary from a few inches to over 40 ft.

The glacial outwash, which is the major source of groundwater in the area, overlies the till. Perlmutter (1962) divided the outwash into two major types: i) Periglacial deposits and ii) Ice-contact deposits. The periglacial deposits in the form of broad outwash plains and sediments in lake bottoms were deposited by streams originating from melting ice. These deposits are made of comparatively well-stratified fine to coarse textured sand, gravel and silt. Most of the finer material is located in deeper beds with thicknesses over 55 ft in lake beds. The ice-contact deposits in the form of elongated mounds called eskers and roughly circular hills called kames are a result of glacial stream action on the landscape. The stratification in these deposits is from poor to good, and grain size distribution varies widely from boulder to clay. The sand and gravel size particles are predominantly quartz while smaller particles (silt and clay) consist mainly of quartz and several types of feldspars.

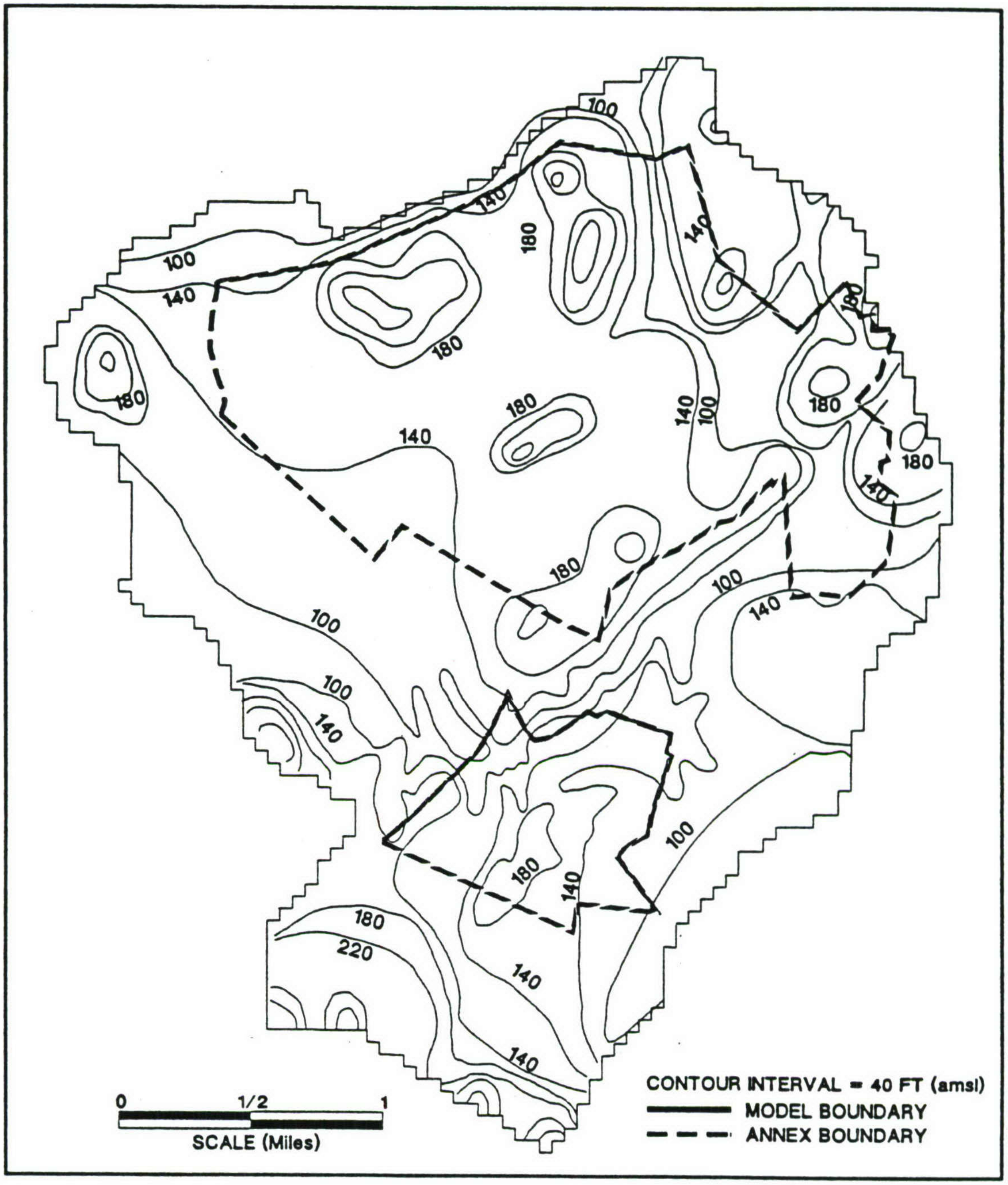


Figure 2.1 Altitude of the top of Bedrock unit.

2.3 HYDROGEOLOGY

All three geological units contain groundwater, however, the glacial outwash is the most important source of groundwater in the area. The groundwater in the bedrock unit is stored in openings along joints and cleavage planes of the bedrock formations discussed in the previous section. There are no reports on the presence of faults or other major fracture zones in the bedrock that would enable the formations to produce significant amounts of water. Groundwater yields of wells drilled into the bedrock were reported (Perlmutter, 1962) to be 3 to 7 gallons per minute (gpm), with static water levels at 24 to 30 ft below the land surface. A small number of domestic wells obtain groundwater from the bedrock units.

The thickness of the till which overlies the bedrock varies from a few inches to over 40 ft in some areas. As mentioned earlier, the till is comprised of highly compact and poorly sorted sand, silt and clay. Consequently, it has a low permeability which makes it a poor source of groundwater.

The outwash contains the largest body of groundwater that is readily available. It overlies the till and is the upper layer of the glacial deposits throughout the site. The hydrogeological properties of the outwash vary with depth. The material in the upper portions of the outwash is primarily made of coarse sand and gravel with relatively high permeability, in contrast to its lower beds which contain finer sand and silt. The coarse grained upper beds are generally 15 to 30 ft thick, however, the total thickness of the outwash varies from a few feet in the vicinity of till hills and bedrock outcrops to about 100 ft in the valleys where streams and lakes are located. The water table is generally less than 15 ft below the land surface. The saturated thickness of the outwash varies widely from a few feet at the base of the hills to 80 ft in the valleys, with an average thickness of about 50 ft. A layer of alluvium several feet thick overlies the outwash in many of the wetlands scattered throughout the site.

A detailed aquifer test was performed by the USGS using a 10-inch diameter water-supply well located approximately 3500 ft east of White Pond in September 1955 (Perlmutter, 1962). Water

level measurements were made in 20 observation wells. The initial thickness of the saturated zone at the pumping well was 45 ft. The well was pumped at rate of 603 gpm. After 50 hrs of pumping a specific capacity of 32 gpm per foot of drawdown was observed at the pumping well. The drawdown decreased from 6.5 ft at a distance of 7 ft from the pumping well to 0.34 ft at a location 440 ft away. A transmissivity value of 34,000 gpd per foot was computed for the aquifer from the data gathered from this test. The corresponding hydraulic conductivity was 101 ft per day (Perlmutter, 1962).

Ecology and Environment, Inc. (E&E, 1994) conducted slug tests at some of the monitoring wells at the site in 1992, and compiled a data base of measured hydraulic conductivities. Figure 2.2 shows the locations of the test sites, and Table 2.1 lists the measured values. The measured hydraulic conductivities range from 0.1 to 45 feet per day. As expected, values in the lower end of the range lie near the foot of the hills, and high values are obtained in the outwash. Most of the wells from which slug test data was obtained were shallow wells screened close to the water table, therefore, measurements made in these wells may not be representative of the entire saturated thickness of the aquifer.

Groundwater elevation in the outwash unit is highly correlated to the topographic features at the site. The water table is highest in the vicinity of the hills and is lowest in the marshes, streams and ponds where the water table is exposed. Therefore, groundwater flow is towards ponds and streams in all parts of the site except in the north where groundwater is discharged directly to the Assabet River. Most of the ponds are connected by streams. Subsurface flow from the uplands into the low lying surface water features is exemplified in the cross-section presented in Figure 2.3. The location of the cross-section is provided in Figure 2.4. The water table is over 200 ft above mean sea level (amsl) in higher topographic locations and varies from 195 to 180 ft (amsl) in most parts of the outwash, except in the Hop Brook area where it is between 170 and 160 ft (amsl). It has been noted that the seasonal variations of the water table is quite minor (Perlmutter, 1962), to the order of a few feet, and that no significant long-term variations have occurred at the site (Hussein Aldis, E&E, personnel communication). Therefore, for purposes of this study, an average annual water table surface (Figure 2.5) was constructed

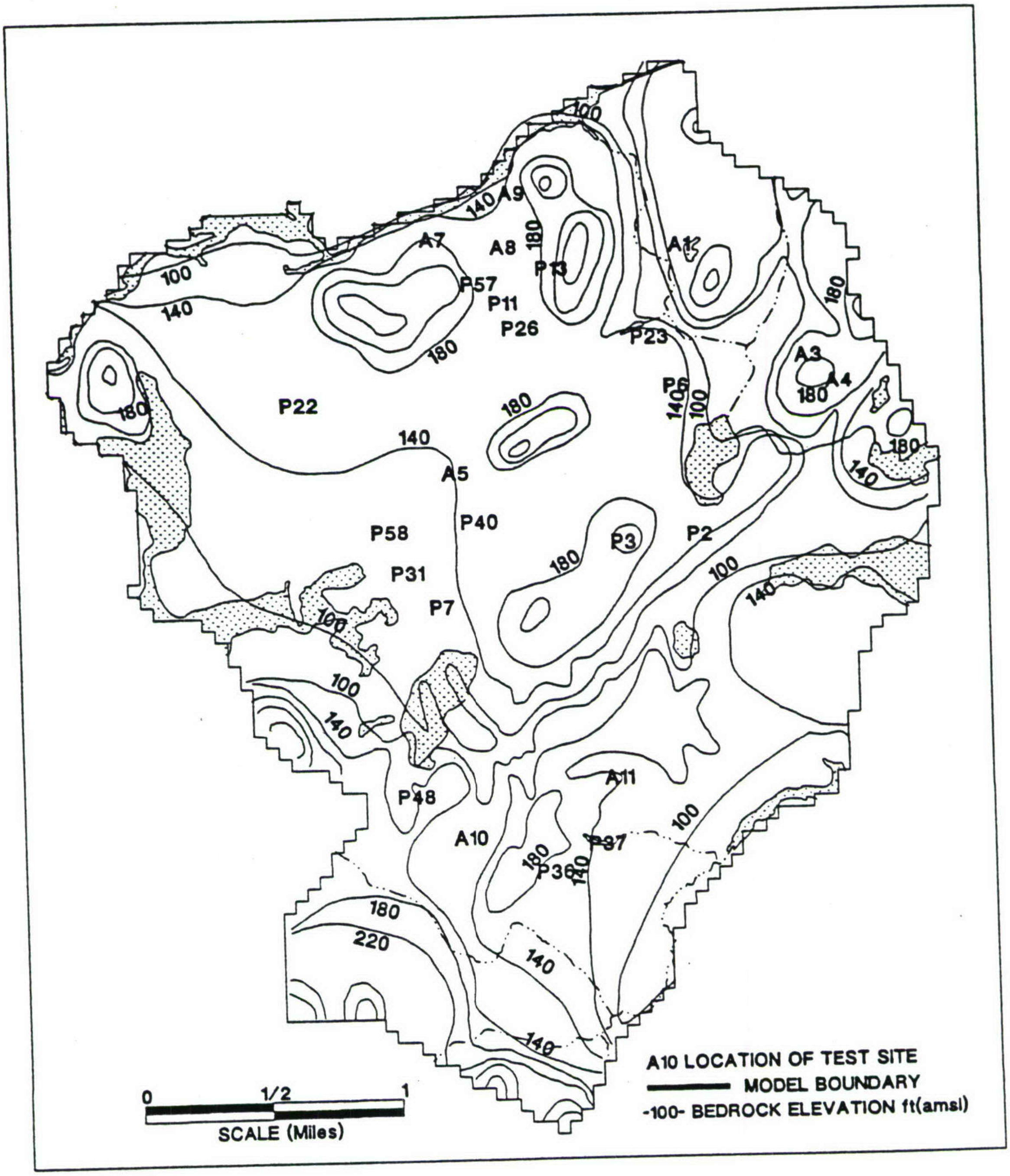
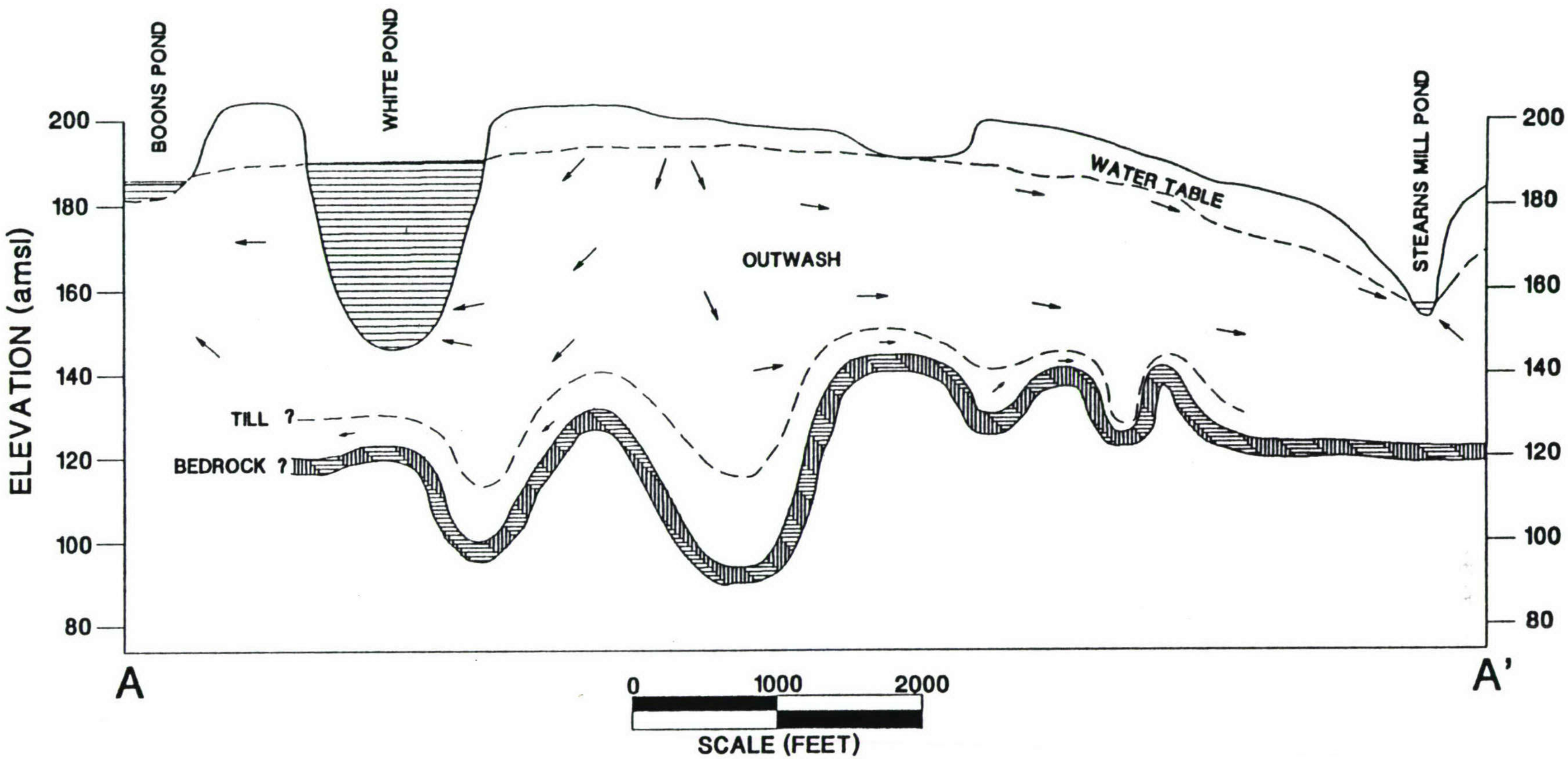


Figure 2.2 Location of slug test sites.

Table 2.1 Results of Slug Tests

AREA	WELL ID	TOTAL DEPTH (ft)	WATER ELEVATION (ft AMSL) (1/8/93)	HYDRAULIC CONDUC. (ft/min)
A1	DM2	15.04	186.6	0.0001
A1	DM3	14.67	188.45	0.007
A1	EHA5	21.88	180.3	
A1	SG-16		180.38	
A1	SG-17		179.6	
A3	OHM-A3-1	17.56	183.2	0.002
A3	OHM-A3-3	15.31	183.32	0.001
A3	EHA6	9.92	189.44	
A4	OHM-A4-4	15.62	196.41	
A4	OHM-A4-5	13.88	184.02	0.001
A4	DM4	16.38	188.88	0.0003
A4	DM5	19.48	195.96	0.0007
A4	EHA7	9.31	197.5	
A4	SG-13		182.6	
A5	OHM-A5-24	18.47	198.45	0.03
A7	OHM-A7-12	19.32	179.4	0.0003
A7	OHM-A7-13	14.84	229.25	
A7	OHM-A7-45	20.05	197.91	8E-05
A7	OHM-A7-46	10.3	203.85	
A7	EHA2	26.86	187.14	
A7	SG-6		176.95	
A8	OHM-A8-14	24.39	192.83	0.002
A8	OHM-A8-15	25.17	192.24	0.0004
A9	OHM-A9-16	70.62	193.54	0.02
A9	OHM-A9-17	58.62	184.85	0.0002
A10	OHM-A10-20	20.25	188.48	0.02
A10	DM1	19.37	188.63	0.05
A10	DM11	20.12	188.79	0.06
A11	OHM-A11-21	18.81	180.61	0.1
A11	OHM-A11-22	19.02	180.18	0.0001
A11	OHM-A11-23	20.21	186.19	0.02
A10	DM7	19.43	188.7	0.02
A11	SG-20		186.05	
P2	E3-P2-M01		189.57	0.0004
P3	E3-P3-M01		223.84	0.0011
P7	OHM-P7-30	16.49	192.84	0.07
P7	OHM-P7-31	15.11	193.43	0.02
P7	SG-1		193.33	
P11	OHM-P11-32	15.57	197.6	0.01
P11	OHM-P11-33	15.27	197.26	0.0006
P11	OHM-P11-34	18.14	196.16	0.001
P11	EHA3	26.93	193.34	
P11	SG-8		193.1	
P11	SG-18		197.15	
P13	E3-P13-M01		195.25	0.001275
P22	E3-P57-MO1		183.84	45.2
P26	E3-P26-M02		189.28	0.006009
P26	E3-P26-M03		188.98	0.0008296
P31	E3-P31-M01		185.11	0.00676
P36	EM-P36-M0		195.49	0.0001571
P36	EM-P36-M02		185.09	0.0001274
P36	EM-P36-M03		177.25	0.0008077
P37	EM-P37-M01		182.36	0.0002519
P37	EM-P37-M02		176.93	0.001938
P37	EM-P37-M03		175.15	0.005847
P40	OHM-P40-29	82.09	195.66	0.0008
P40	OHM-P40-38	16.69	196.45	0.04
P40	OHM-P40-39	20.77	196.57	0.006
P57	E3-P57-MO1			0.5
P58	E3-P58-M02		184.74	0.004985

Source: E&E(1994)



SOURCE: U.S. GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1539-E (Perlmutter, 1962)

Figure 2.3 Hydrogeological cross-section showing conceptual groundwater flow at Sudbury Annex.

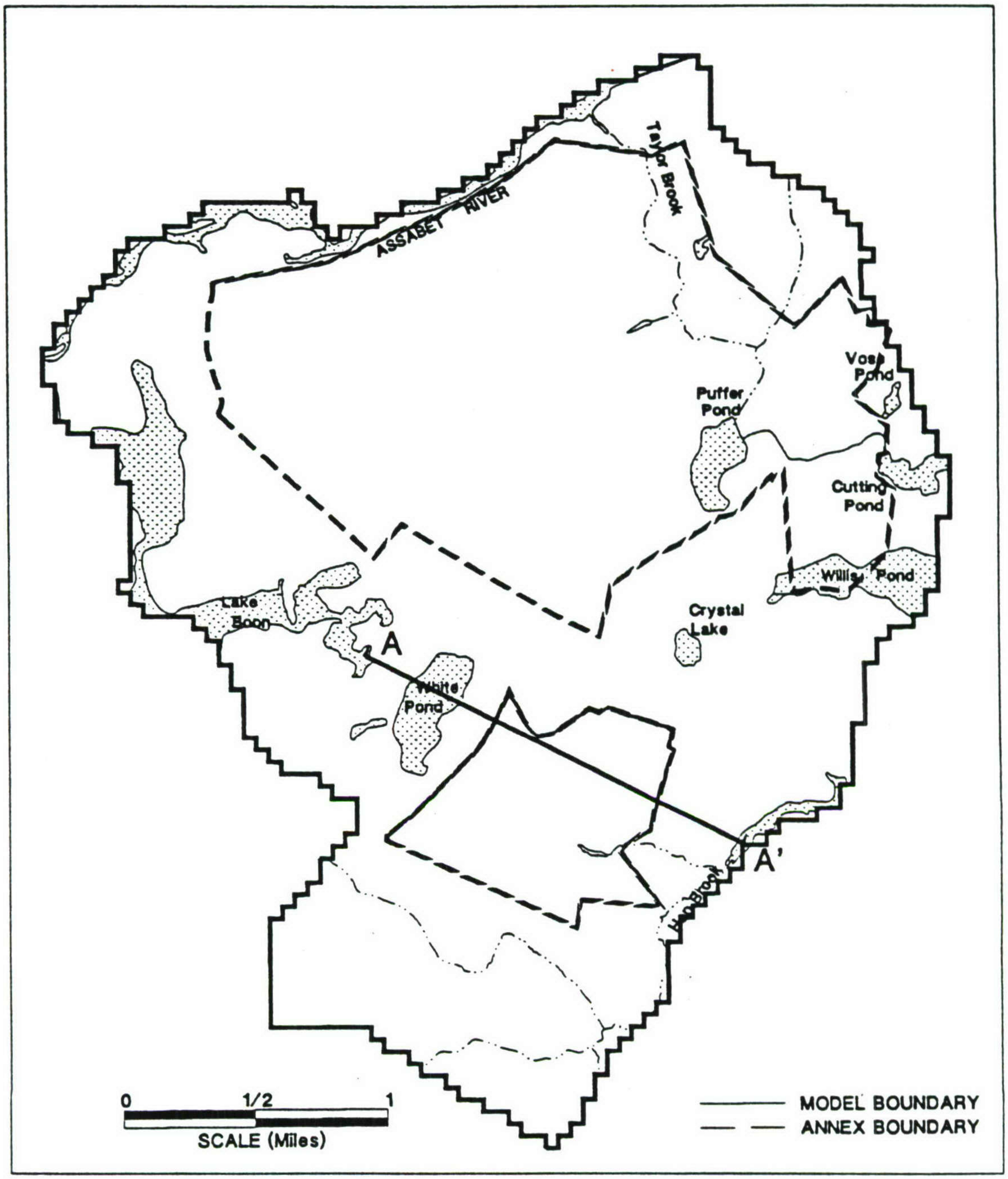
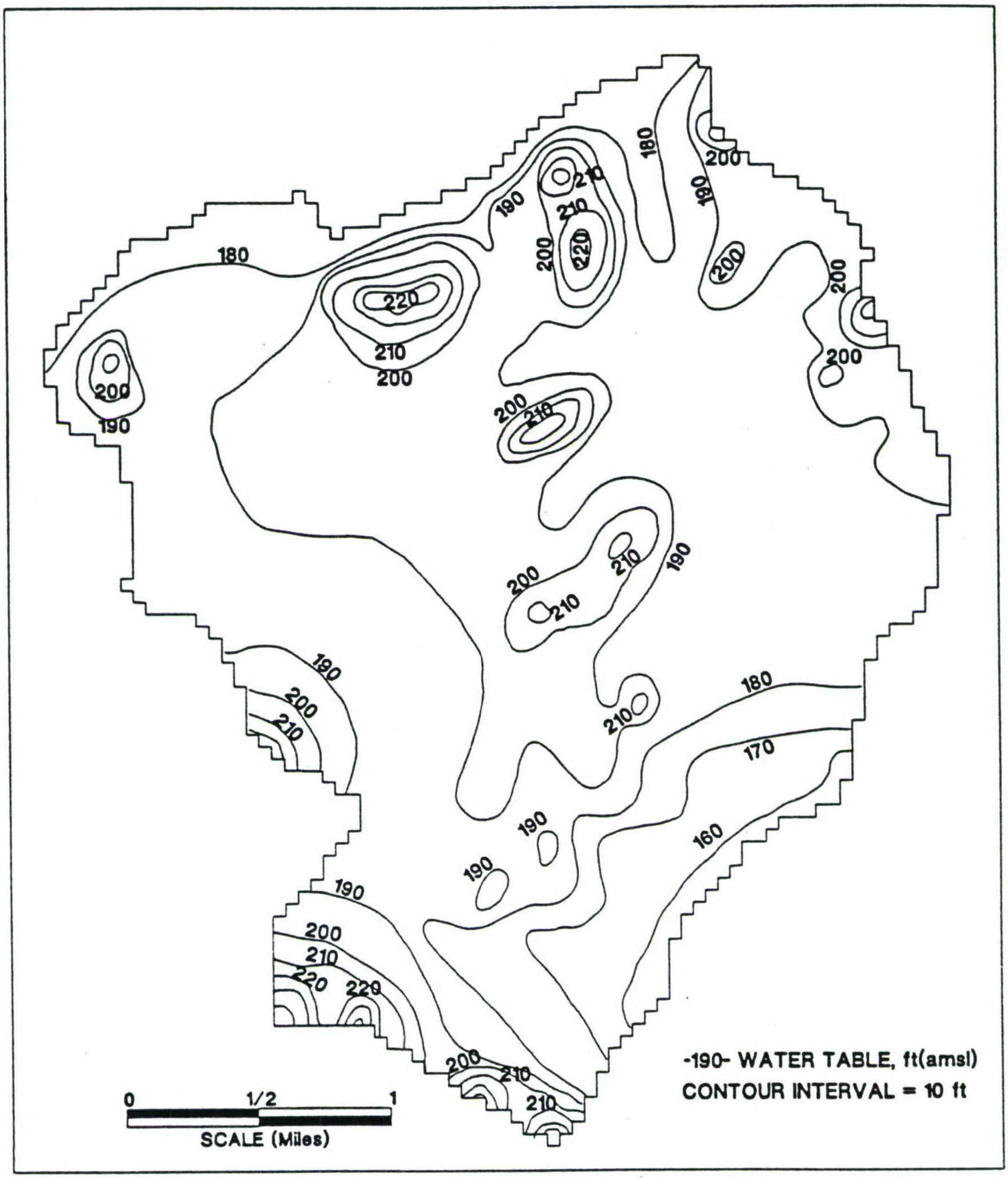


Figure 2.4 Base map showing location of cross-section.



INTERPRETED WATER TABLE

Figure 2.5 Interpreted average annual water table.

utilizing water level data from E&E (1994), and Perlmutter (1962). Where data gaps existed, the water table was obtained through the aid of USGS topographic maps and observations regarding typical depths to the top of the zone of saturation in both the hills and valleys at the site. The water table map henceforth shall be referred to as the interpreted water table in the remaining sections of this report.

The configuration of the water table surface indicates the existence of five major groundwater divides at the site. These correspond to the surface watersheds at the site. Figure 2.6 shows their locations and boundaries. The first watershed, Lower Taylor Brook, covers the northern section of the study site, and its main features are the hills in the northern border of the Annex and the marshes and streams in lower Taylor Brook valley. The discharge point of this watershed is the Assabet River. The second watershed, Upper Taylor Brook comprises Puffer, Cutting and Vose ponds, Vose hill and the swampy area in between them. Water flows from the wetlands east of Cutting Pond and from the vicinity of Vose Hill and eventually into Vose, Cutting and Puffer ponds. In the western part of this watershed, water flows from the hills into the tributaries of Taylor Brook. The Willis pond watershed, is located immediately south of Puffer and Cutting ponds and covers most of the area east of White Pond and north of Hop Brook Valley. Its major discharge locations are Willis Pond, Crystal Lake, and the marsh in between the two. The fourth watershed covers the southeastern portion of the study site. Its comprises the area east of Bruen Road and south of Crystal Lake. Water in the northern area of this watershed generally flows south and east towards the Hop Brook valley. In the southern portion, flow is towards the tributaries of Hop Brook. Lake Boon watershed, the last of the five, covers much of the western part of the site including White Pond. It borders along Bruen Road in the southeast and Sudbury Road in the north. The discharge locations of this watershed are Lake Boon, White Pond and the Assabet River in the northwest.

Pumping of water from surface water bodies and groundwater wells has been going on at the site for several decades. In the early 1950s, withdrawal of water by the Town of Maynard took place at White Pond, a water table pond, where daily withdrawals ranged from 420,000 to 450,000 gpd as reported by Perlmutter (1962). An additional 79,000 gpd were pumped from

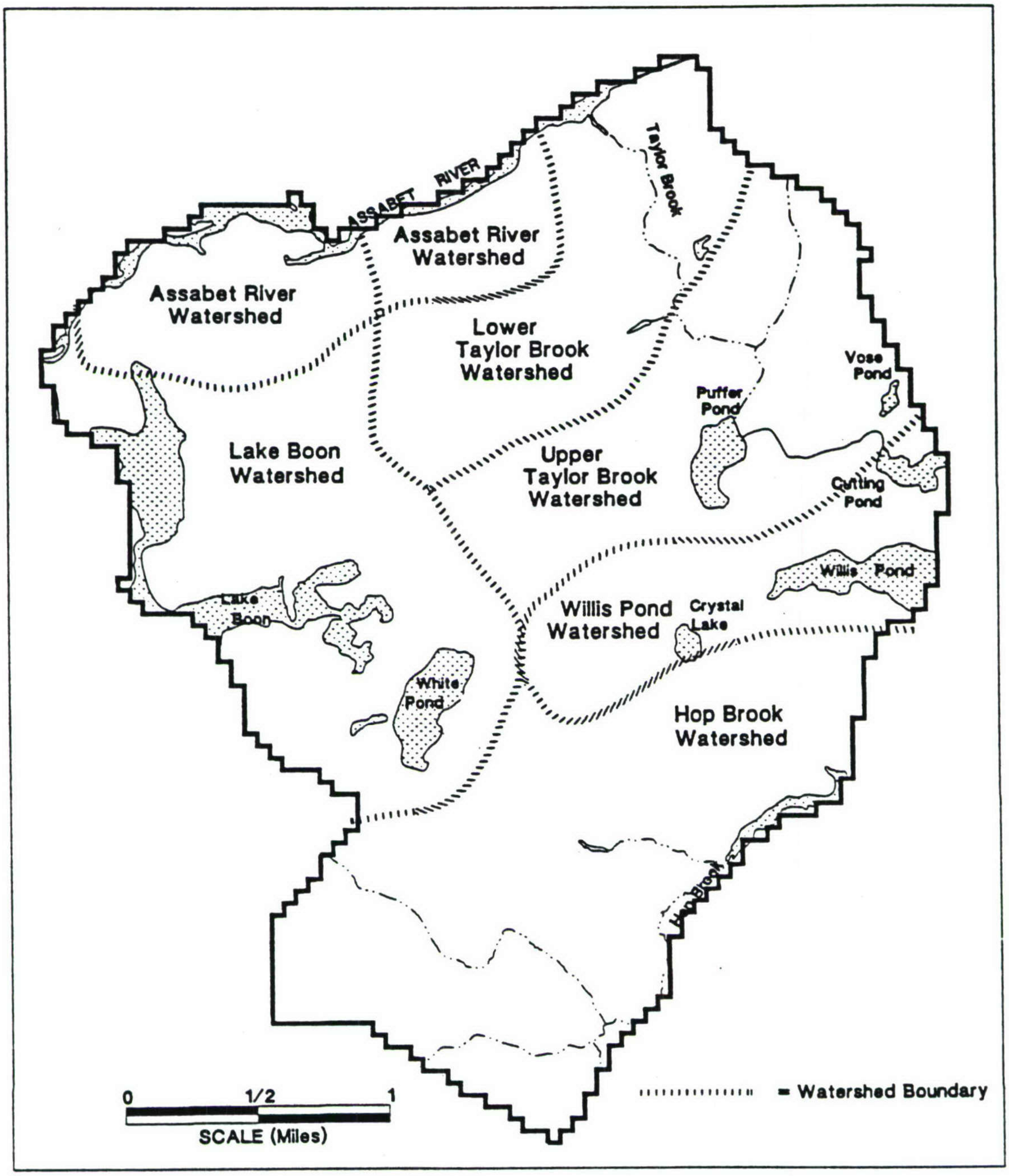


Figure 2.6 Watershed boundaries at Sudbury Annex and vicinity.

groundwater wells to supplement water demand for public supply, industry and agriculture. In 1993, withdrawal of water by pumping from White Pond was about a 100 million gallons, with monthly withdrawals ranging from 18 million gallons in July to 2 million gallons in January (Hussein Aldis, personal communication). This is down from the levels of pumping in the 1950s. Since White pond is hydraulically well connected with the underlying aquifer, the impact of present day pumping is directly reflected in its current stage of 186 feet (amsl).

3.0 GROUNDWATER FLOW MODELING

3.1 CONCEPTUAL MODEL

The conceptual model developed for the quantitative analysis of groundwater flow is illustrated in Figure 2.3. The hydrogeologic cycle consists of water entering the subsurface in the form of precipitation, recharging all three geologic units prior to discharging into the river, ponds and streams at the site. Direct precipitation onto natural and artificial ponds with large surface areas provide additional recharge to the system.

3.2 CODE SELECTION

The United States Geological Survey (USGS) three-dimensional groundwater flow code MODFLOW (McDonald and Harbaugh, 1988) was selected for use in this study because it is a well-accepted, public domain groundwater code. It has the capability to incorporate appropriate system features, is computationally efficient, and is relatively easy to use. MODFLOW is designed to simulate steady-state or transient groundwater flow through heterogeneous, anisotropic porous media in three dimensions subject to a variety of complex boundary conditions. The code, therefore, is quite versatile in that it can be used to simulate a wide variety of hydrogeological conditions that may exist in the field. There are, however, certain intrinsic limitations associated with MODFLOW. These limitations, primarily as they relate to the current work, are listed below:

- MODFLOW is designed to simulate groundwater flow in porous media; the code may not be used to explicitly model flow in individual fractures, faults, or solution cavities.

- The effects of density and/or temperature on the groundwater flow field are not considered. Therefore, in regions where the dissolved solids content of the groundwater is high enough to effect the pattern of groundwater flow, these concentration (density) effects are neglected.

- The aquifer material within individual grid cells is assumed to be homogeneous, and the grid is assumed to be aligned with the principal directions of hydraulic conductivity if the aquifer material is anisotropic.

- Stresses applied to a grid cell are assumed to be distributed uniformly over the cell face.

3.3 GRID DESIGN

The modeled domain is discretized in two dimensions by a rectangular grid with a uniform spacing of 250 feet in both directions (Figure 3.1). This level of detail was deemed sufficient to simulate flow through the principal aquifer, the glacial outwash. It also provides adequate resolution to outline the surface water features in sufficient detail. In regions where the bedrock outcrops, the hydraulic gradients are quite steep, and a finer grid resolution would be desirable. However, since the water table in the outcrop is not to be calibrated, and since the quantity of water flowing from the outcrop into the glacial outwash is independent of the level of grid size in the outcrop, any refinement of the grid in the outcrop regions was considered to be unproductive.

Vertically, the aquifer is divided into three layers in order to simulate flow in each of the three hydrogeologic units. Since the rate of vertical flow within the bedrock is negligible, the base of the model is arbitrarily set to a no-flow condition at a depth of 30 feet from the top of the bedrock unit. The lowest layer therefore has a uniform thickness of 30 feet, and the base elevation of the model in each cell is obtained by subtracting 30 feet from the top of the bedrock presented in Figure 2.1. A ten-foot thick till layer overlies the modeled bedrock unit. The actual thickness of the unit at the site varies from zero feet to several tens of feet. However, since, the till layer does not contain significant amount of groundwater, it was represented simplistically by a 10 feet thick uniform layer. Unlike the till and bedrock layers which were modeled as confined aquifers, the outwash represents an unconfined aquifer. For unconfined layers, MODFLOW requires specification of the bottom elevation of the modeled layer. The base of the outwash was obtained by adding 10 feet to the bedrock elevation throughout the

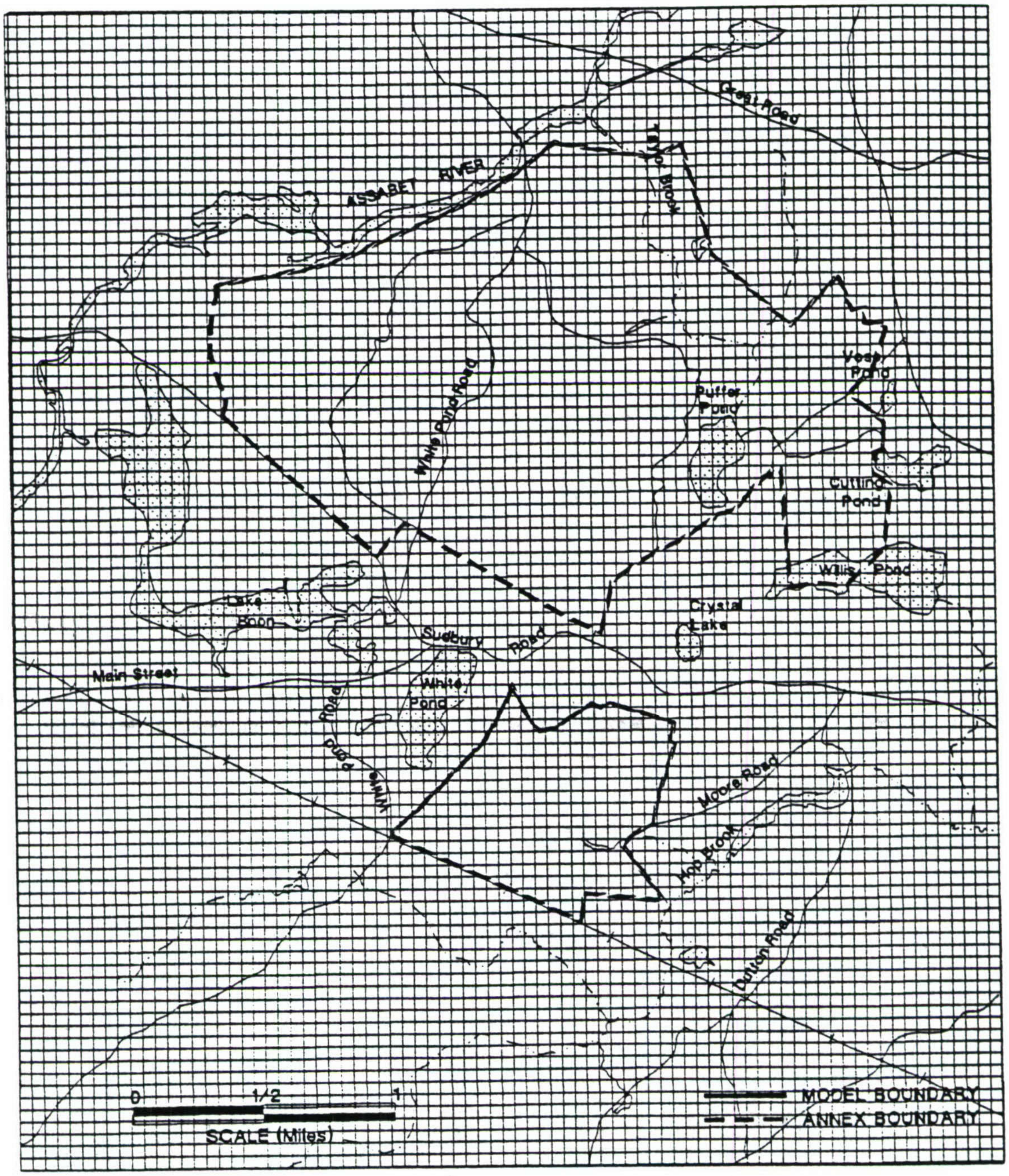


Figure 3.1 Regional model grid.

modeled domain except where the bedrock outcrops. In such regions, the modeled elements in all three layers represent the bedrock unit, and therefore the base of the topmost layer was set close to the base of the bedrock unit.

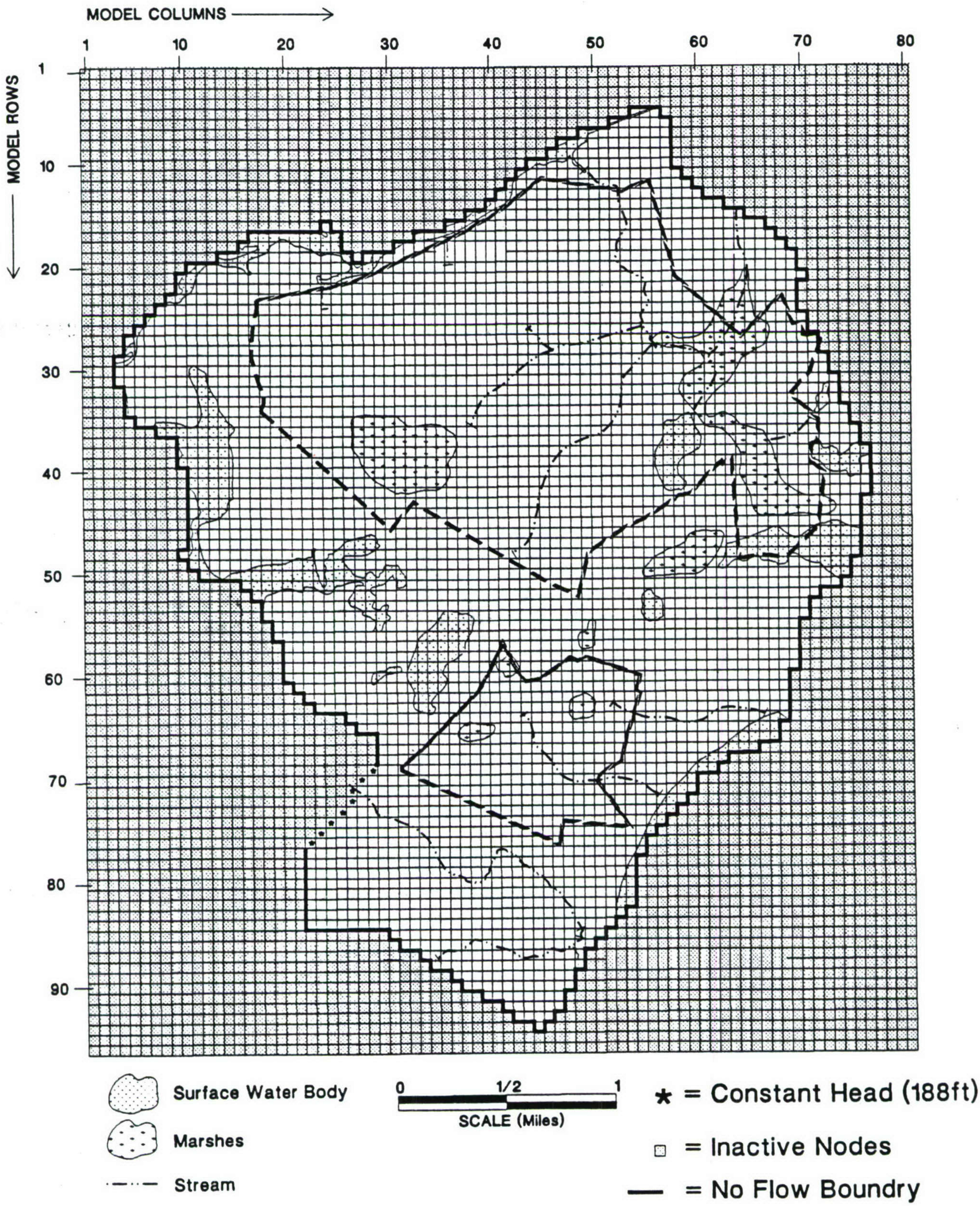
Each layer of the grid consists of 96 rows and 137 columns, giving a total of 7,680 nodes of which 4,133 nodes are active in each layer. The total number of nodes in all three layers is therefore 23,040, of which 12,399 nodes are active.

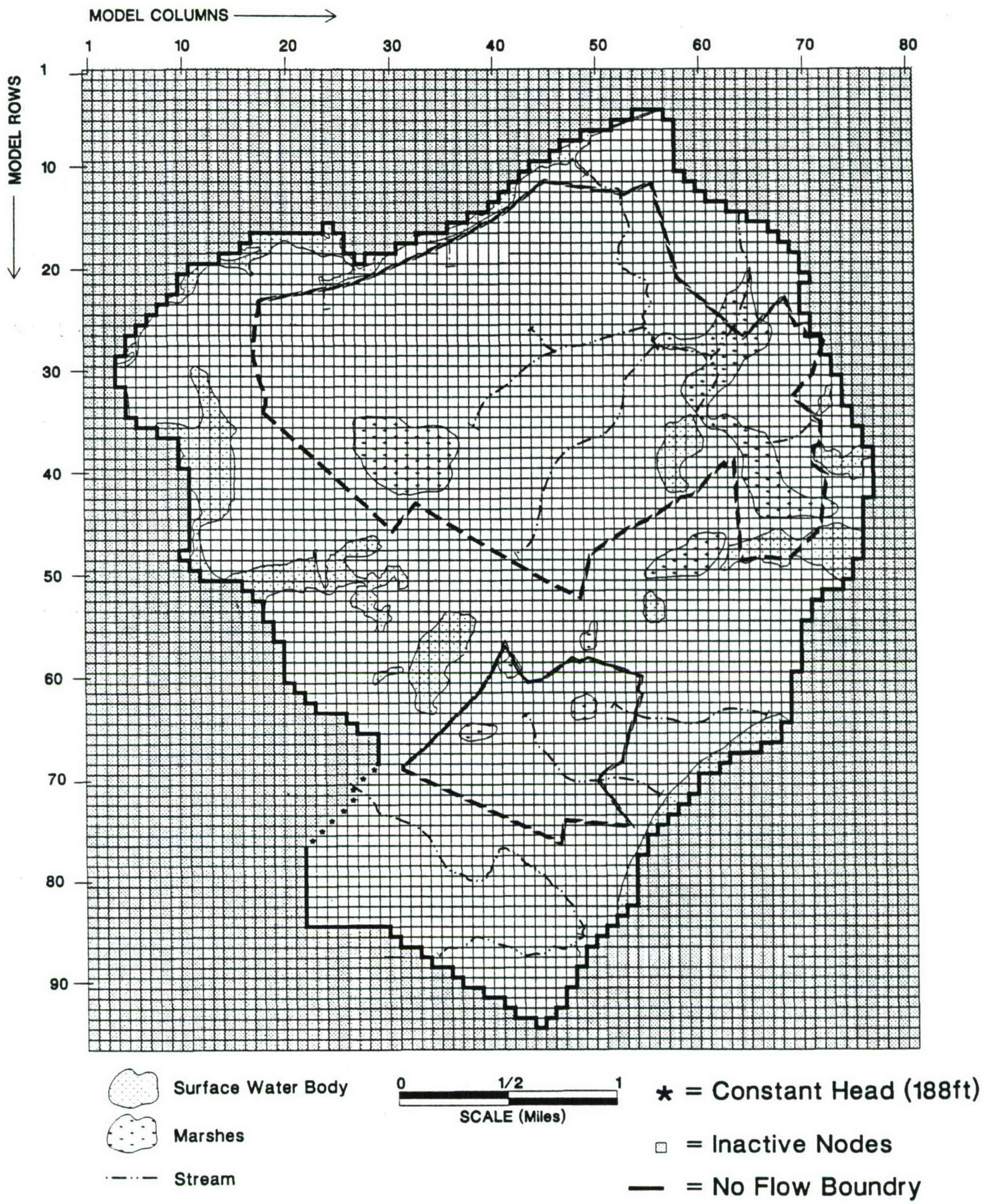
3.4 MODEL INPUT

3.4.1 Boundary Conditions

A combination of constant head, prescribed flux, and head-dependent flux boundary conditions were specified for the model. Appropriate consideration was given to maintain boundaries as close as possible to the site without interfering with the natural flow of surface and ground water within the domain. The areal delineation of the boundaries are shown in Figure 3.2. No-flow boundary condition is prescribed in all 3 layers along the Assabet River in the north and Hop Brook in the southeast. This ensures that groundwater discharges from the subsurface into the river and stream. No-flow condition is also prescribed along most of the remaining boundary through all three layers as it coincides with the groundwater divide in the area. The divides are formed either by the exposed bedrock or by discharging ponds. A series of constant head nodes are prescribed along the boundary southwest of White Pond. The boundary there lies within a marshy region where the exact direction of groundwater flow could not be determined. The prescribed constant head value there is 188 feet.

Since vertical flow within the bedrock is negligible, a no-flow boundary was prescribed along the base of the model. Along the top, recharge was specified in both the glacial outwash and bedrock outcrops. Hydraulic interaction between the surface water and groundwater was simulated through the RIVER package of MODFLOW. This is a head-dependent boundary condition, with the magnitude of the vertical flux between the two water bodies given by:


MODEL COLUMNS
1
10
20
30
40
50
60
70
80
MODEL ROWS
1
10
20
30
40
50
60
70
80
90
Surface Water Body
Marshes
Stream
0
1/2
1
SCALE (Miles)
* = Constant Head (188ft)
= Inactive Nodes
= No Flow Boundry



MODEL COLUMNS
1
10
20
30
40
50
60
70
80
MODEL ROWS
1
10
20
30
40
50
60
70
80
90
Surface Water Body
Marshes
Stream
0
1/2
1
SCALE (Miles)
* = Constant Head (188ft)
= Inactive Nodes
= No Flow Boundry

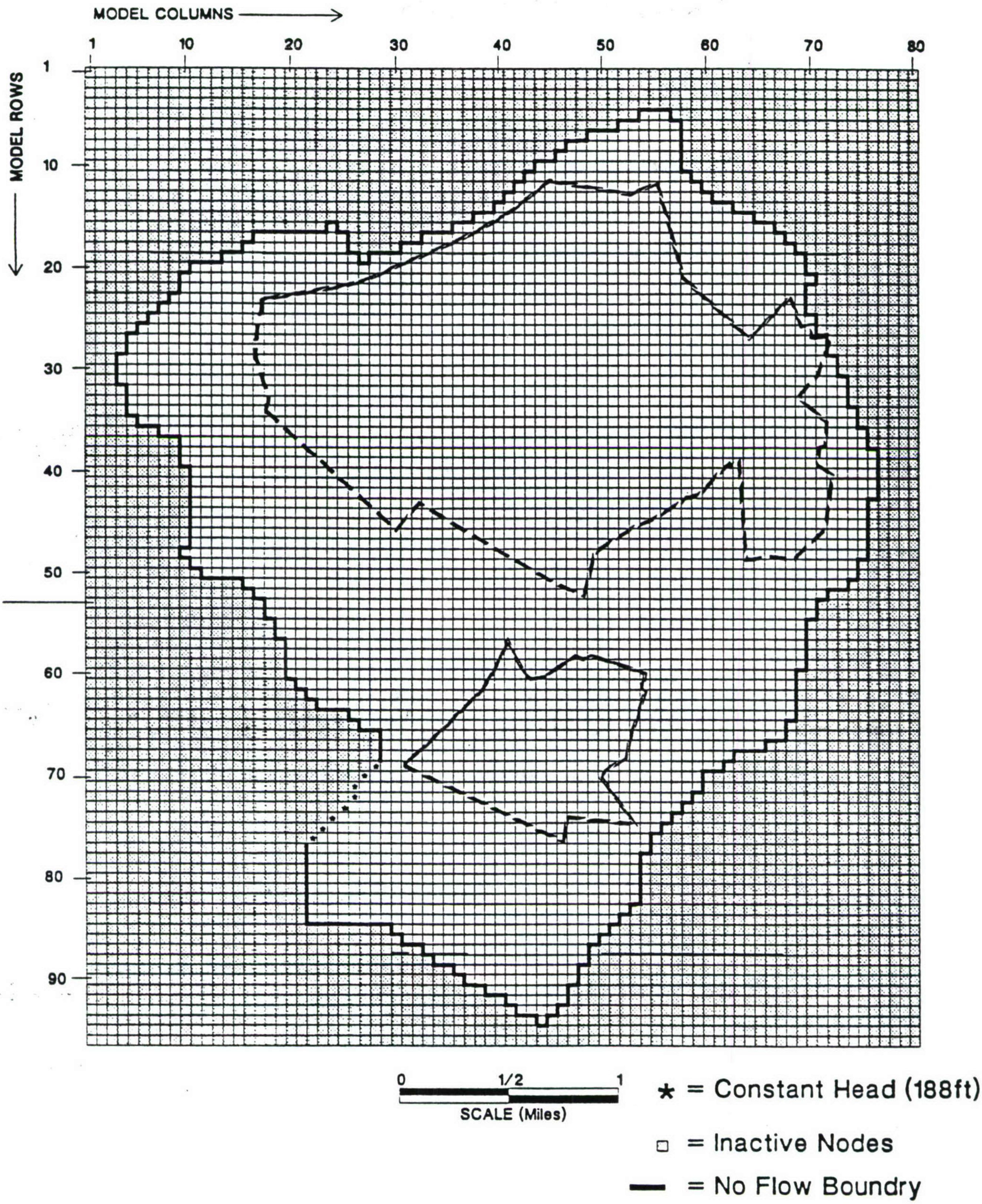


Figure 3.2 Model grid and associated boundary conditions.

$$q_v = CD\ (h_s - h_a)$$

where q_v is the vertical Darcy flux entering or exiting the aquifer, h_s is the prescribed stage of the surface water body, h_a is the simulated hydraulic head in the aquifer, and CD is the conductance of the river/pond bed. As further discussed in the following section, the conductance was set to a high value (99,999 sq ft/d) in order to ensure that the surface water stage nearly coincides with the water table elevation. The prescribed water levels of the surface water features were obtained from E&E (1994), Perlmutter (1962), and USGS topographic maps. These are presented in Figure 3.3. The Assabet River is dammed throughout the year at a fixed elevation of 176 feet. The stage in the other streams was assumed to drop approximately linearly from upstream to downstream.

Both ground and surface water are withdrawn from the site for various purposes since the early 1950s. Non-municipal groundwater withdrawal is mainly concentrated along the shores of Lake Boon. Some pumpage also occurs from domestic wells spread around the area. However, this is negligible compared to the municipal pumping of approximately one hundred million gallons per year from White Pond. Therefore, non-municipal pumpage was neglected in the calibration process, as its influence on the water table elevation was deemed insignificant. The effect of withdrawal from White Pond is represented by its current stage of 186 feet (amsl).

3.4.2 Hydrogeologic Parameters

The physical parameters input to the model were the hydraulic conductivities, vertical conductances between the aquifer units, and the hydraulic conductances of the river/pond beds. Initial estimates of the hydraulic conductivities were obtained from borehole test data discussed in Section 2.3. The horizontal conductivity in the outwash was estimated to range from 10 ft/d to 100 ft/d. The conductivity in the bedrock and the till was estimated to lie between 0.01 to 1 ft/d. The leakance between two adjacent units was estimated as the ratio of the average vertical conductivity of the units to their average saturated thickness. The vertical hydraulic conductivity was estimated to be one tenth the horizontal conductivity. The conductance of the

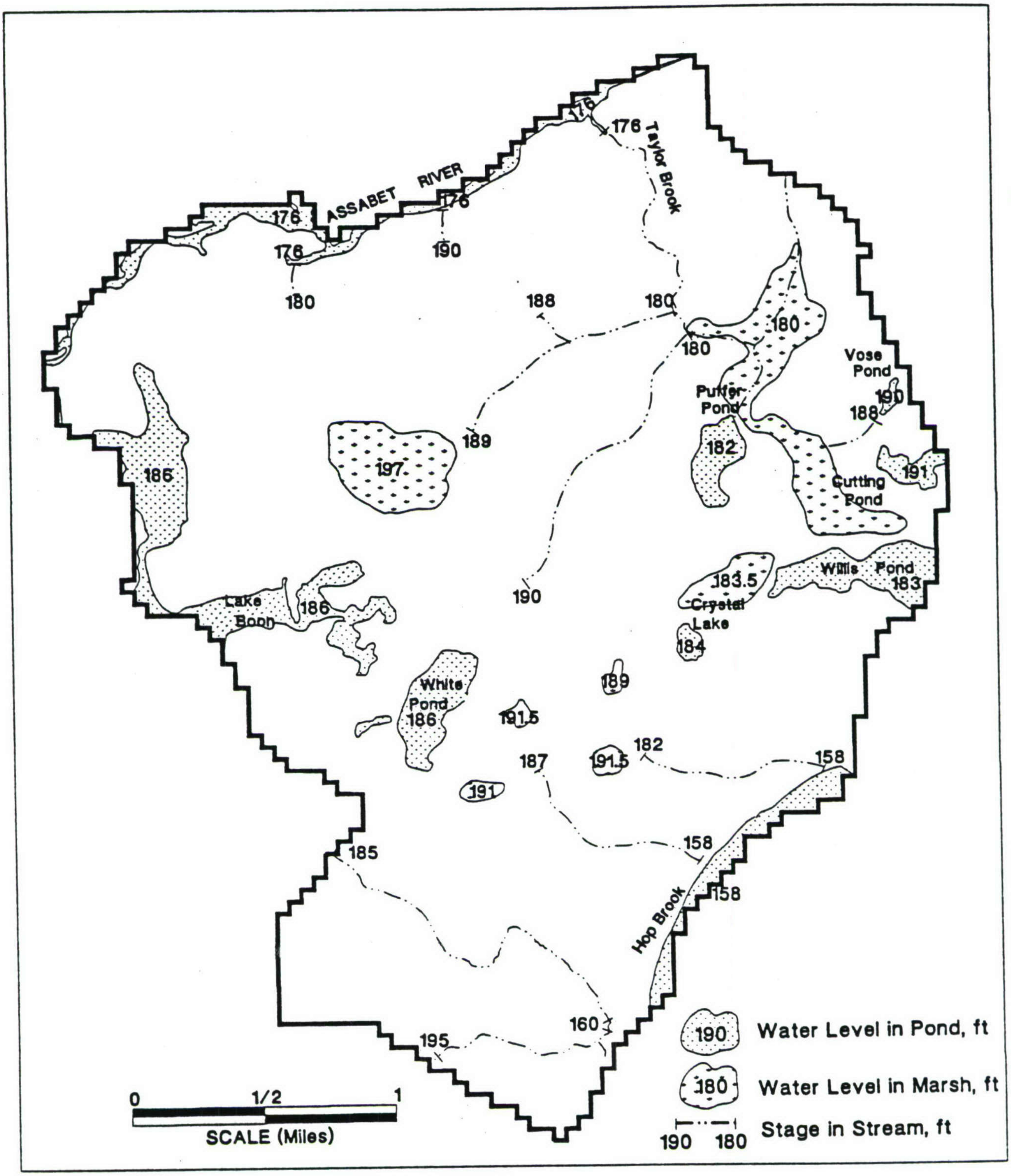


Figure 3.3 Surface water levels prescribed to river package of MODFLOW.

river and ponds was obtained by noting that the hydraulic elevations in the surface bodies at the site coincide with the top of the saturated zone (Perlmutter 1962). Therefore, the conductance of the river and pond beds was arbitrarily set to a high value (99,999 sq. ft/d) in order to ensure that surface water bodies are hydraulically in full contact with groundwater throughout the modeled domain.

3.5 MODEL CALIBRATION

3.5.1 Overview & Targets

The groundwater flow dynamics at the site is hydrogeologically complex but conceptually simple. Water enters the subsurface in the form of precipitation flowing towards drainage areas formed by numerous streams, ponds, and marshes. The modeled domain therefore consists of several watershed regions. The process of calibration, hence, involves determining the appropriate rate of infiltration into the system, and the hydrogeologic permeabilities of the different subsurface layers in order to obtain a water table configuration representative of the site.

The primary objective of this study is to develop a groundwater flow model capable of assisting in hydrogeologic investigations for the purpose of studying the long-term cumulative impacts of continuous pumping of water and the migration of potential contaminants in and around the site. For such a time scale, a steady-state rather than a transient model suffices, especially since the seasonal fluctuations of the water table at the site is quite low (Perlmutter, 1962), and no appreciable long-term variations have been noted (Hussein Aldis, personal communication). The calibration target for this model is therefore the long-term annual average water table discussed in Section 2.3 and presented in Figure 2.5.

Another calibration target is the amount of groundwater discharging into White Pond, a major source of water for the Town of Maynard. Approximately 100 million gallons is pumped annually from White Pond. Since White Pond is only about 40 acres and it loses approximately

35 million gallons per year from evapotranspiration while receiving perhaps 45 million gallons per year from precipitation (Hussein Aldis, personal communication), the remaining 90 million gallons per year must be accounted for by groundwater discharge into White Pond. Therefore, the calibrated groundwater model was expected to account for approximately 90 million gallons per year discharge into White Pond.

3.5.2 Calibration Process

The process of calibration involved adjusting the model parameters in order to minimize the difference between the interpreted and simulated water table elevations. The calibration parameters were primarily the hydraulic conductivities of the hydrogeologic units and the recharge/discharge to the groundwater system. The river/pond stage and the bedrock elevation were initially adjusted slightly in order to maintain conformity with the conceptual model. Initial estimates of the conductivities and recharge were obtained from Perlmutter (1962), and E&E (1994). Numerous simulations were then conducted in order to obtain a simulated water table surface that was in close agreement with the interpreted water table. The model was then considered calibrated, and a reliable predictive tool for remediation and environmental impact assessments.

3.6 RESULTS

The calibrated water table is shown in Figure 3.4. For comparison, it is superimposed on top of the interpreted water table in Figure 3.5. In general, the difference between the interpreted and simulated heads are less than 2 feet in the outwash. In the bedrock outcrop, the differences in water levels is relatively larger. It should be noted, however, that the water levels in the outcrops are mainly based on interpretation of the topography, and since the hydraulic gradients are very steep, a slight misplacement of a contour line on the observed map, or a small shift in the simulated hydraulic values, may easily cause large discrepancies. Furthermore, and more importantly, it should be realized that simulated water levels in the outwash, which are of primary interest in this study, are not affected by the head distribution in the outcrop and only

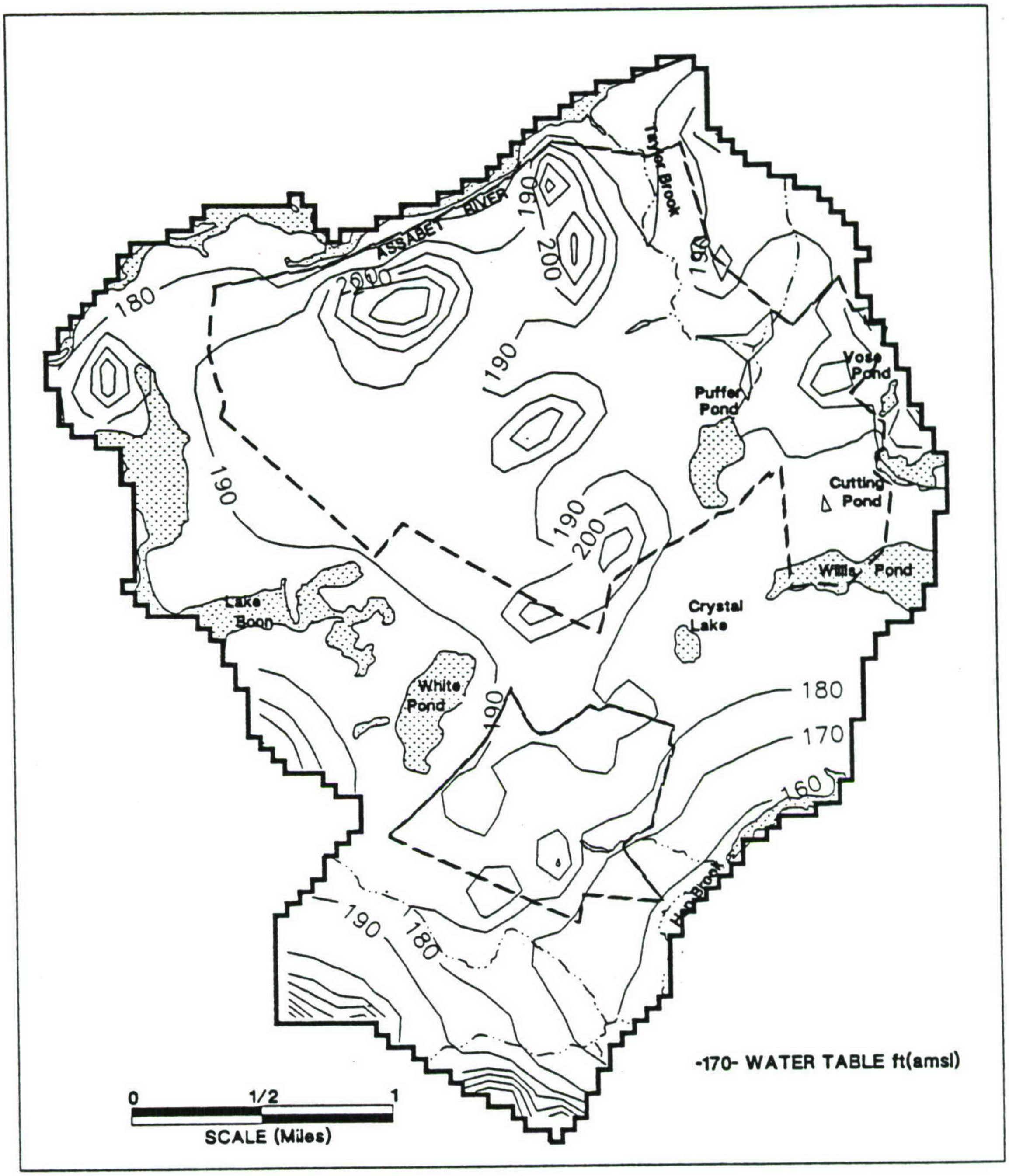


Figure 3.4 Calibrated water table.

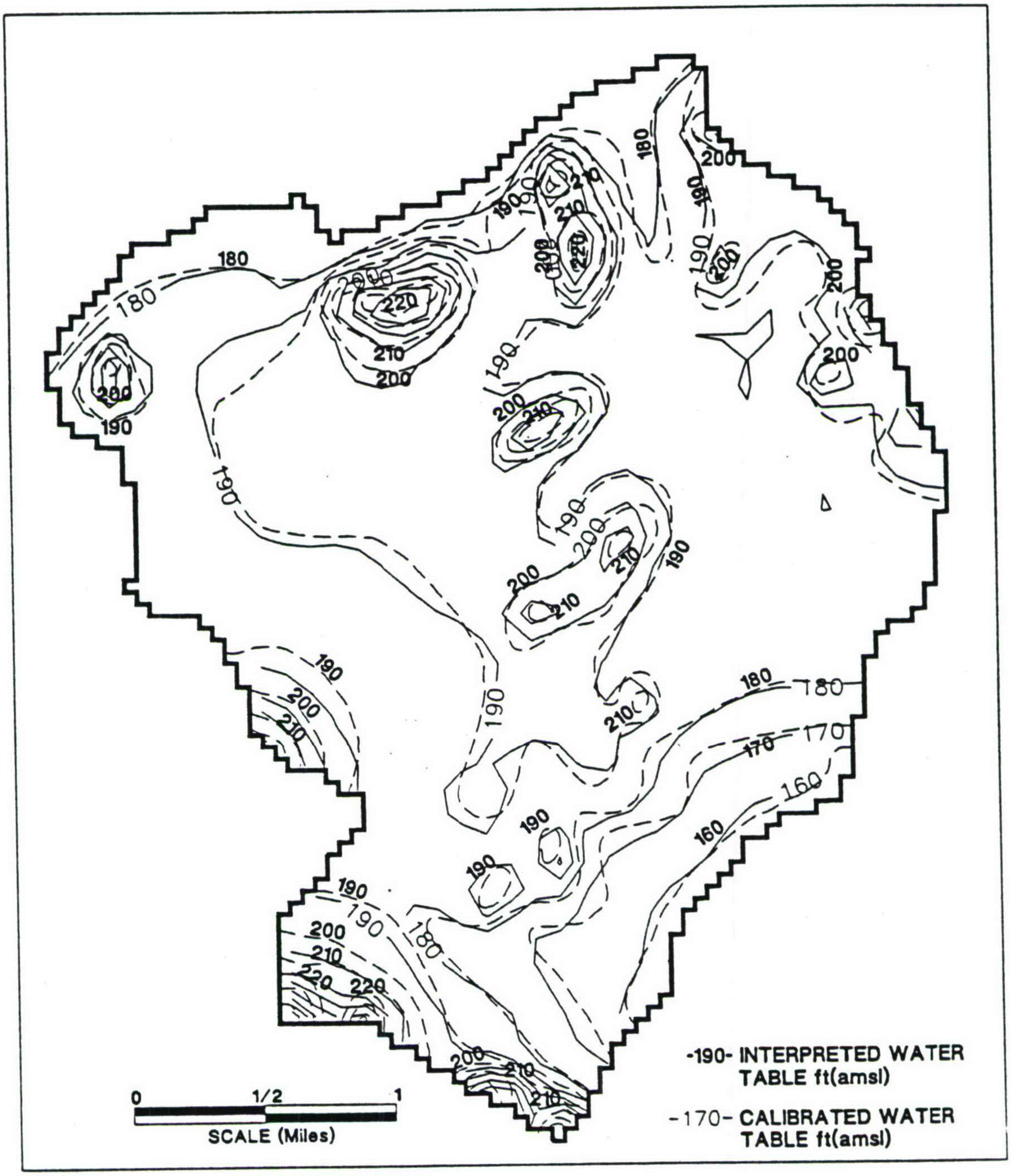


Figure 3.5 Comparison of calibrated and interpreted water levels.

depend on the rate of recharge in the outcrops.

The hydraulic heads within the modeled till and bedrock units, the lower two units, are presented in Figures 3.6 and 3.7. As expected, they mimic the water table since flow within all geologic units has to conform with the regional watershed configuration. However, since the rate of flow between the outwash and the lower units is negligible, water table profile is determined almost entirely by areal flow within the glacial outwash. Therefore, for all practical purposes the lower two layers may be neglected for modeling the water table surface.

The calibrated recharge distribution in the domain is presented in Figure 3.8. A uniform 20 inches per year recharge was applied over the glacial outwash. This is close to the 22 inches per year average suggested by Perlmutter (1962). A decreased recharge of 10 to 15 inches per year was applied over the outcrops in order to emphasize the probability of increased runoff. The effect of recharge in the river and other surface water bodies including marshes was directly incorporated by the stage prescribed to the MODFLOW river package as shown earlier in Figure 3.3.

The calibrated hydraulic conductivities in the lower units which represent the bedrock and till layers are 0.1 and 1.0 respectively. As discussed earlier, the model is insensitive to these parameters. The calibrated horizontal hydraulic conductivity in the top layer, which represents the glacial outwash in most of the domain except where the bedrock outcrops, is presented in Figure 3.9. The conductivity ranges from 10-90 ft/d in the outwash. This is consistent with the range obtained from borehole tests discussed in Section 2.3. In the outcrops, the calibrated conductivity ranges from 0.01 to 1 ft/d.

Since MODFLOW is a quasi three-dimensional code, the vertical component of flow is accounted for by leakance between the modeled layers. The calibrated leakance between the outwash and till units was 0.05, and 0.003 between the till and bedrock. As expected, the model was insensitive to this parameter.

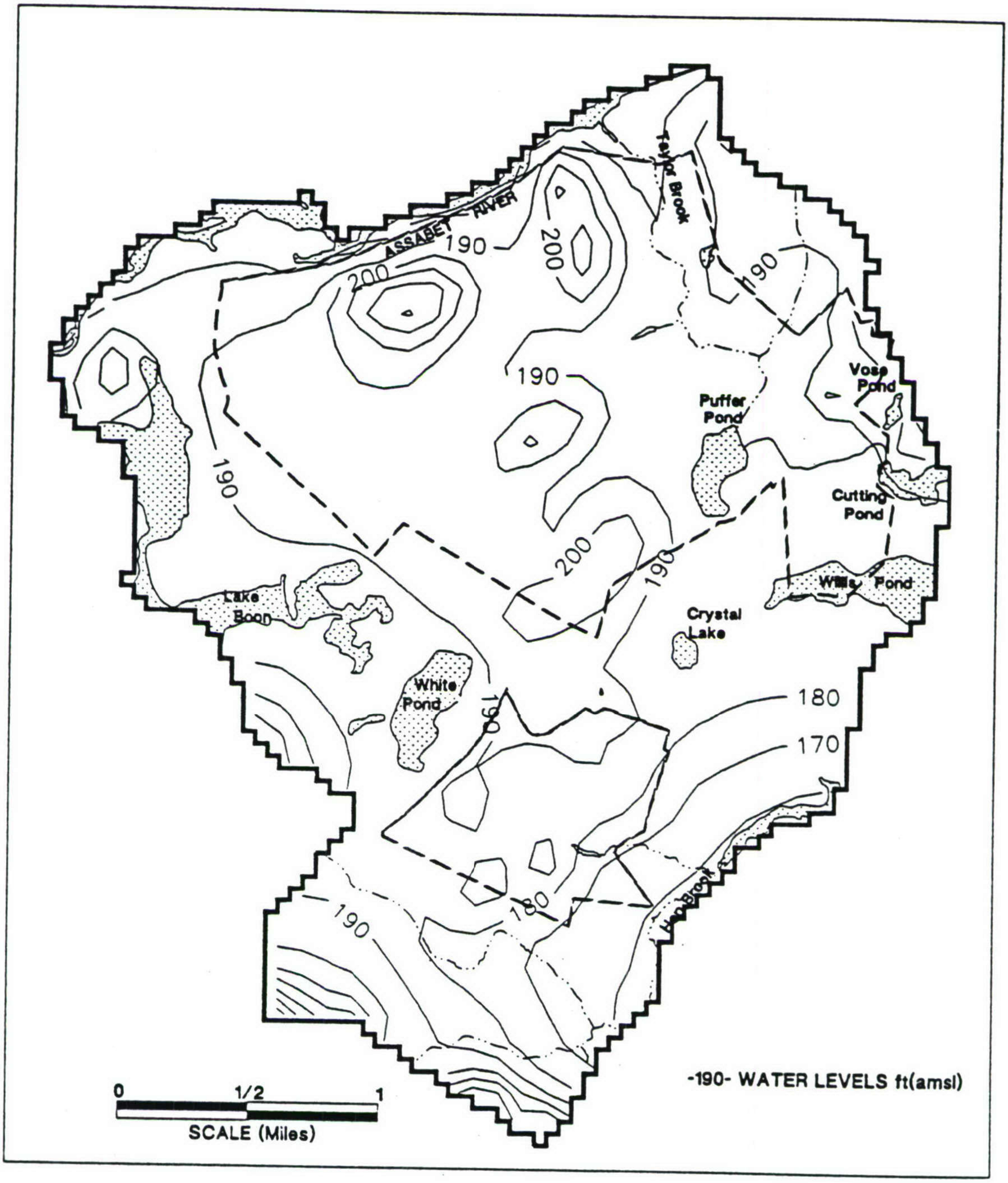


Figure 3.6 Water levels in middle modeled layer which represents the till unit.

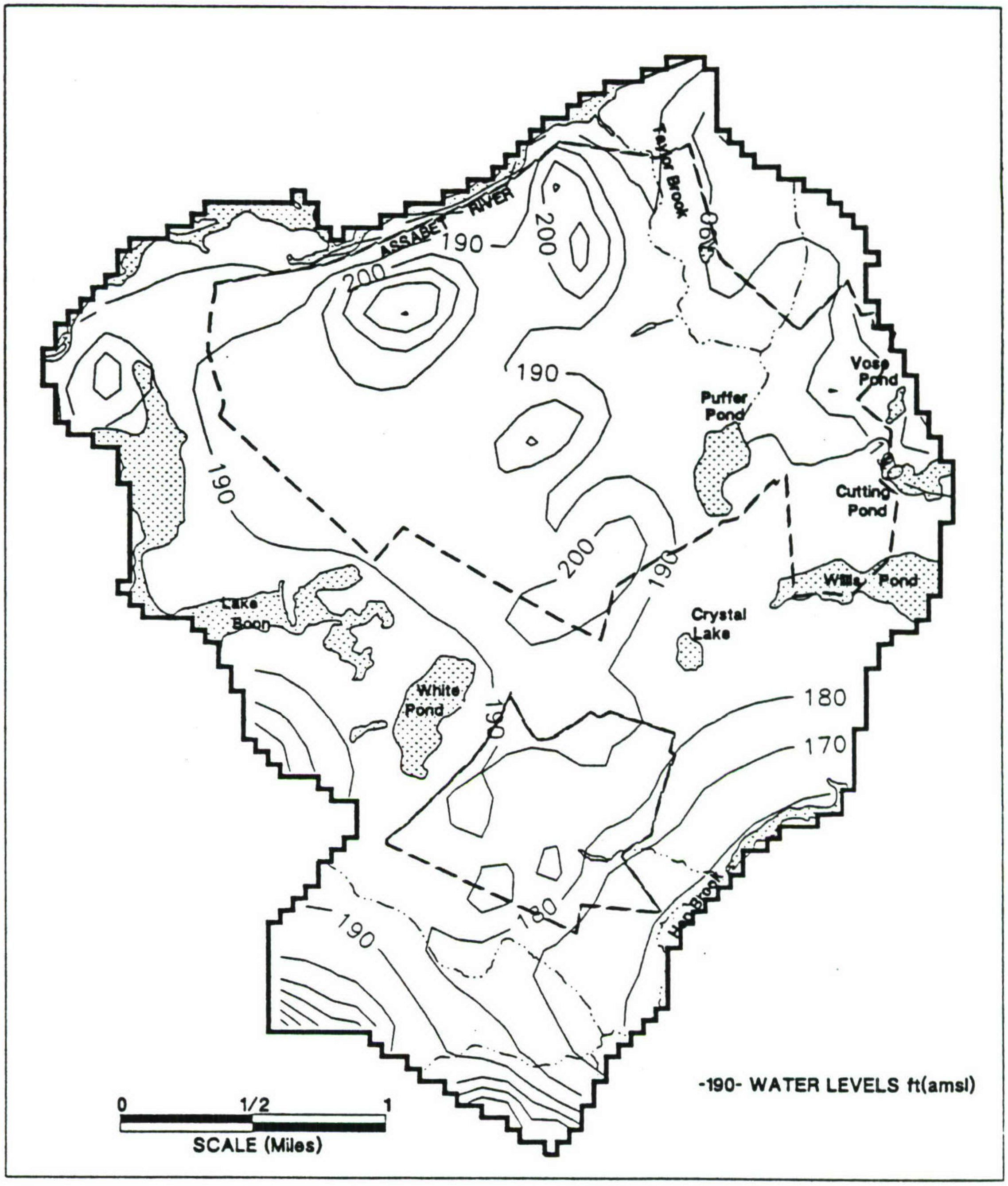


Figure 3.7 Water levels in lowermost modeled layer which represents the bedrock unit.

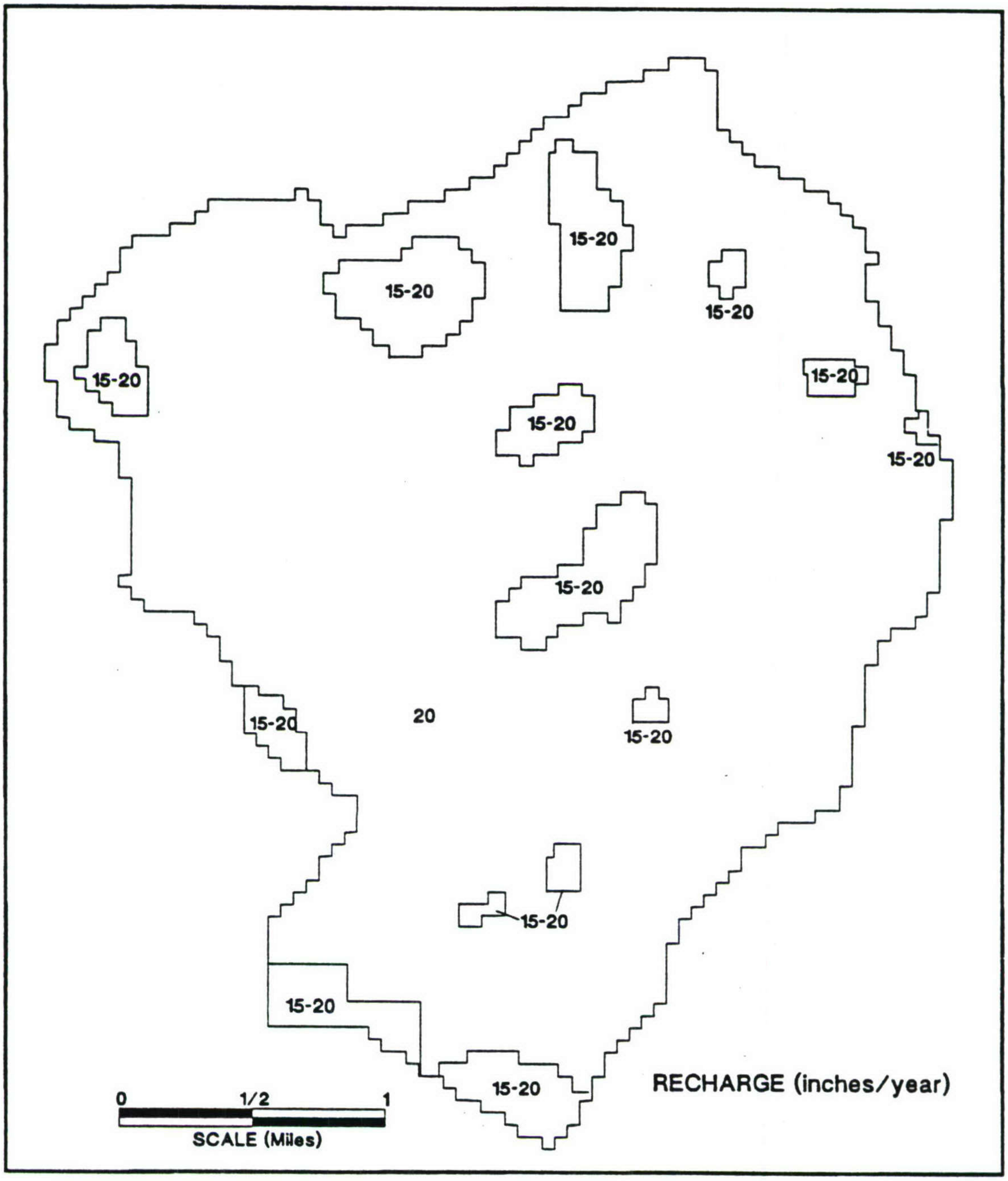


Figure 3.8 Calibrated areal recharge.

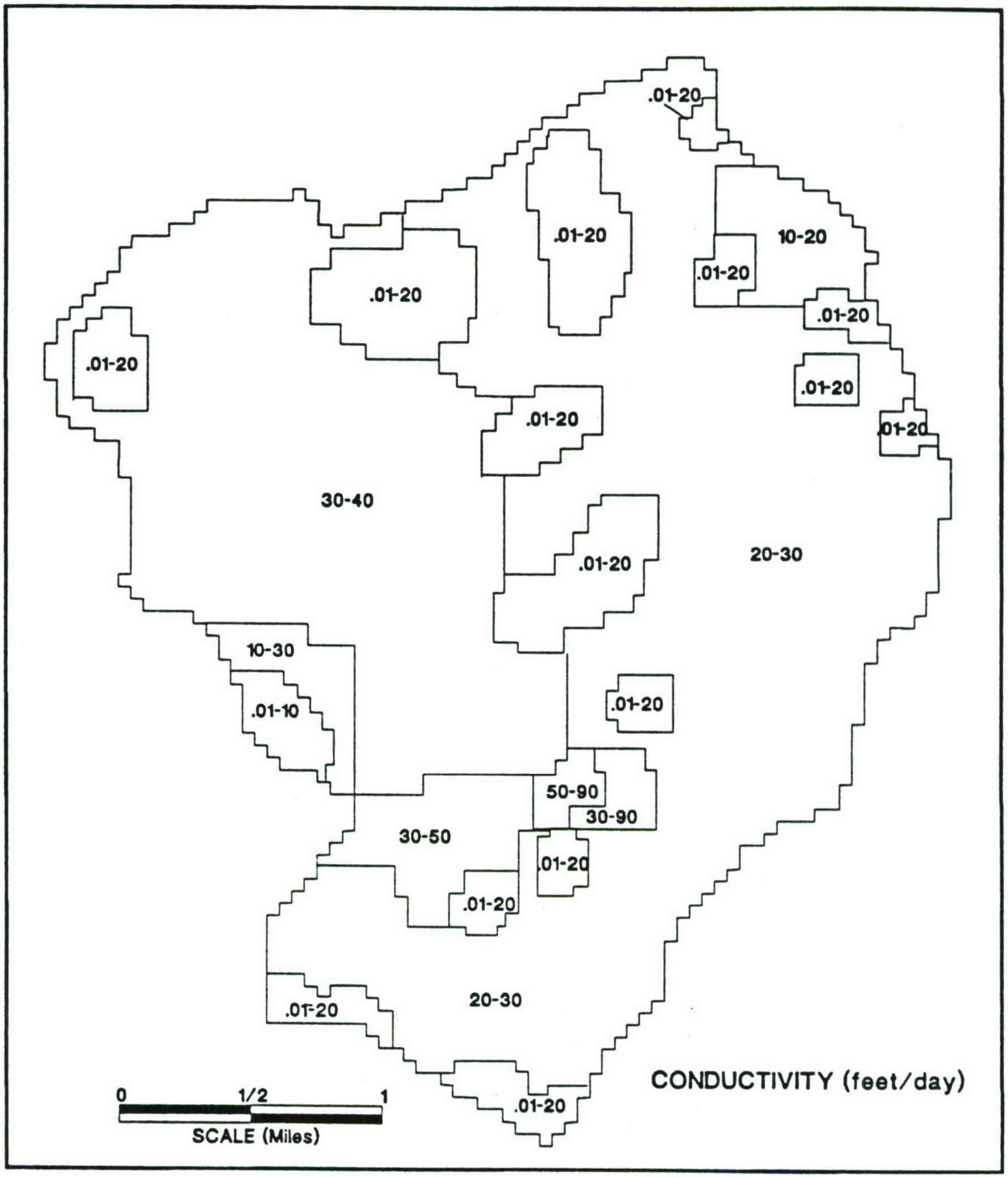


Figure 3.9 Calibrated horizontal hydraulic conductivities in topmost modeled layer.

The Darcy velocity vectors in the topmost modeled unit are presented in Figure 3.10. Flow emanates from the outcrops, traversing through the outwash prior to discharging into the ponds and streams. Due to the steep slopes, the rate of flow is approximately an order of magnitude larger in the outcrops than in the outwash. In order to emphasize the subsurface watersheds in the modeled domain, a logarithmic scale velocity plot for the topmost layer is presented in Figure 3.11. The existence of watersheds discussed in Section 2.3 are clearly evident in this plot. In order to demonstrate the utility of the model as a tool for remedial investigations, the entire travel path for particles released at several locations at the site is shown in Figure 3.12. The particle tracks reveal the complex hydrogeologic flow patterns existing at the site. Contaminants infiltrating the subsurface at close proximity eventually travel in entirely opposite directions.

The total simulated groundwater discharge into White Pond is 108.3 million gallons per year (mgy). This is approximately 8 percent greater than the estimated 100 mgy municipal withdrawal by the Town of Maynard, and about 20 percent higher than the calibration target of 90 mgy. This suggests that if the withdrawal and evapotranspiration rates for White Pond are reliable, then either recharge in the Lake Boon watershed near White Pond is approximately 20 percent less than the calibrated case, or the southeastern boundary of the watershed is slightly westward of that suggested by the model. A slightly higher water level in Lake Boon and White Pond can cause a westward shift of the watershed.

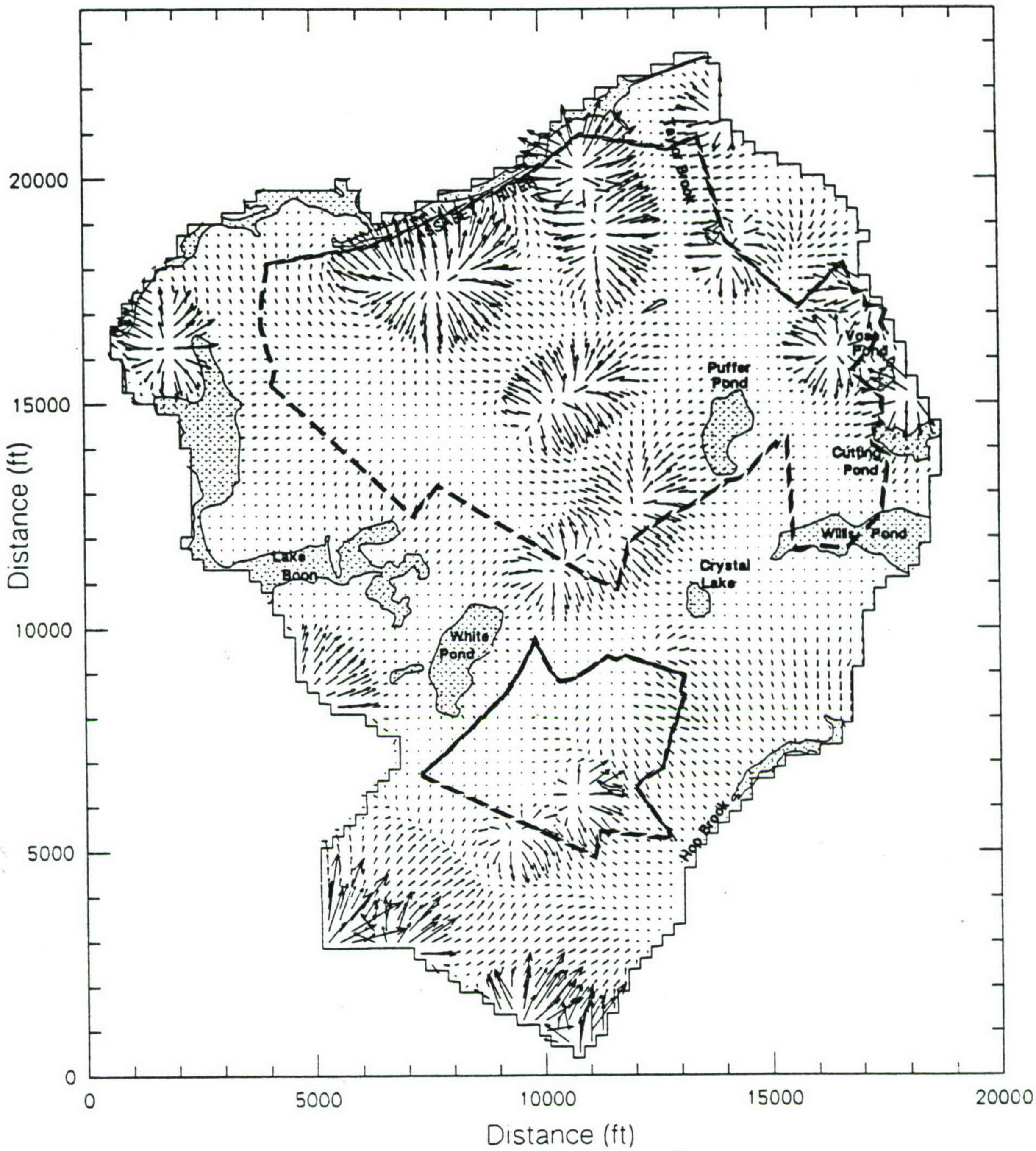


Figure 3.10 Darcy velocity vectors in topmost modeled layer. The length of the vector arrow is proportional to magnitude of velocity.

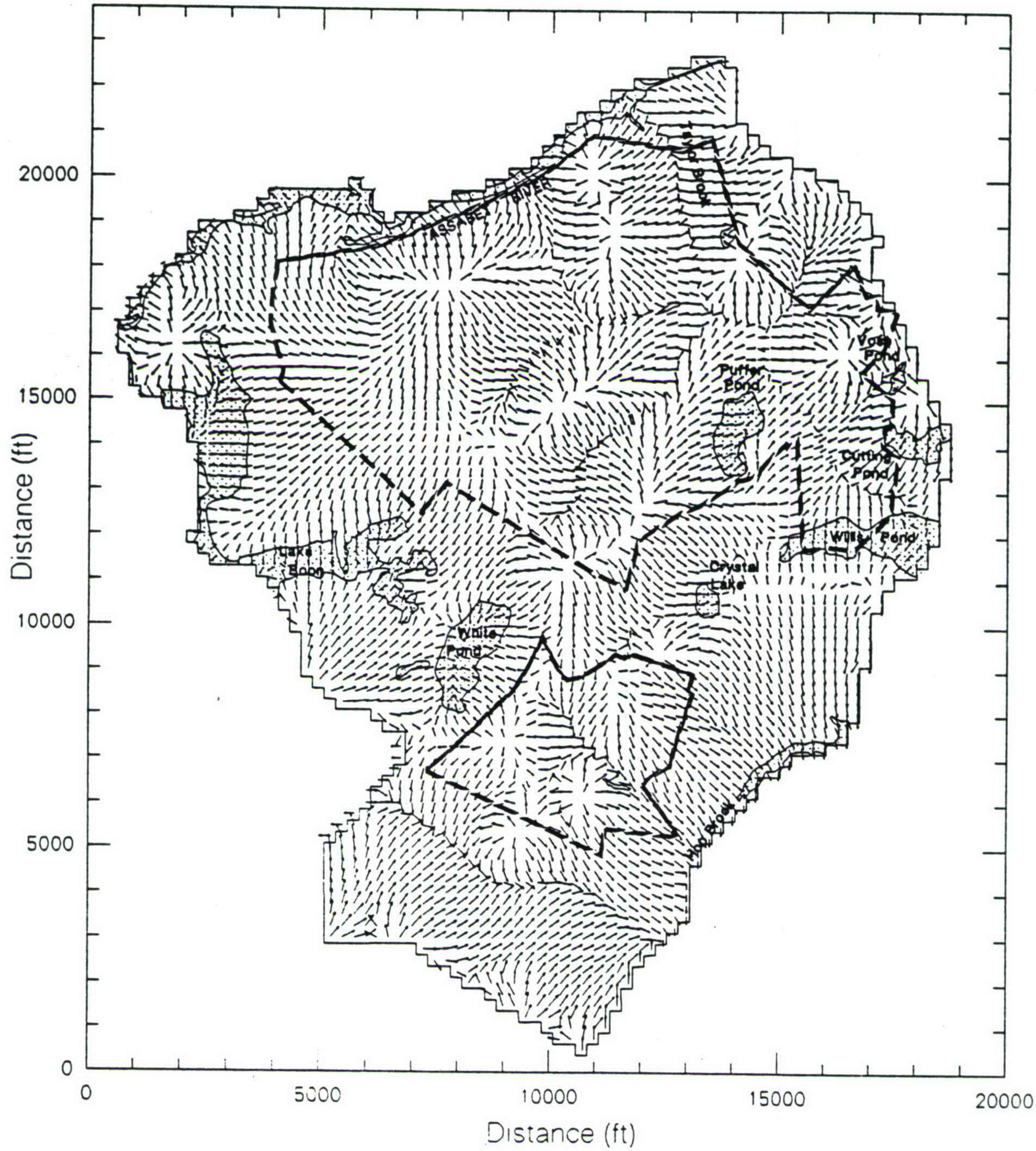


Figure 3.11 Log normalized Darcy velocity vectors in topmost modeled layer. Length of vector arrow is proportional to the logarithm of the magnitude of the velocity.

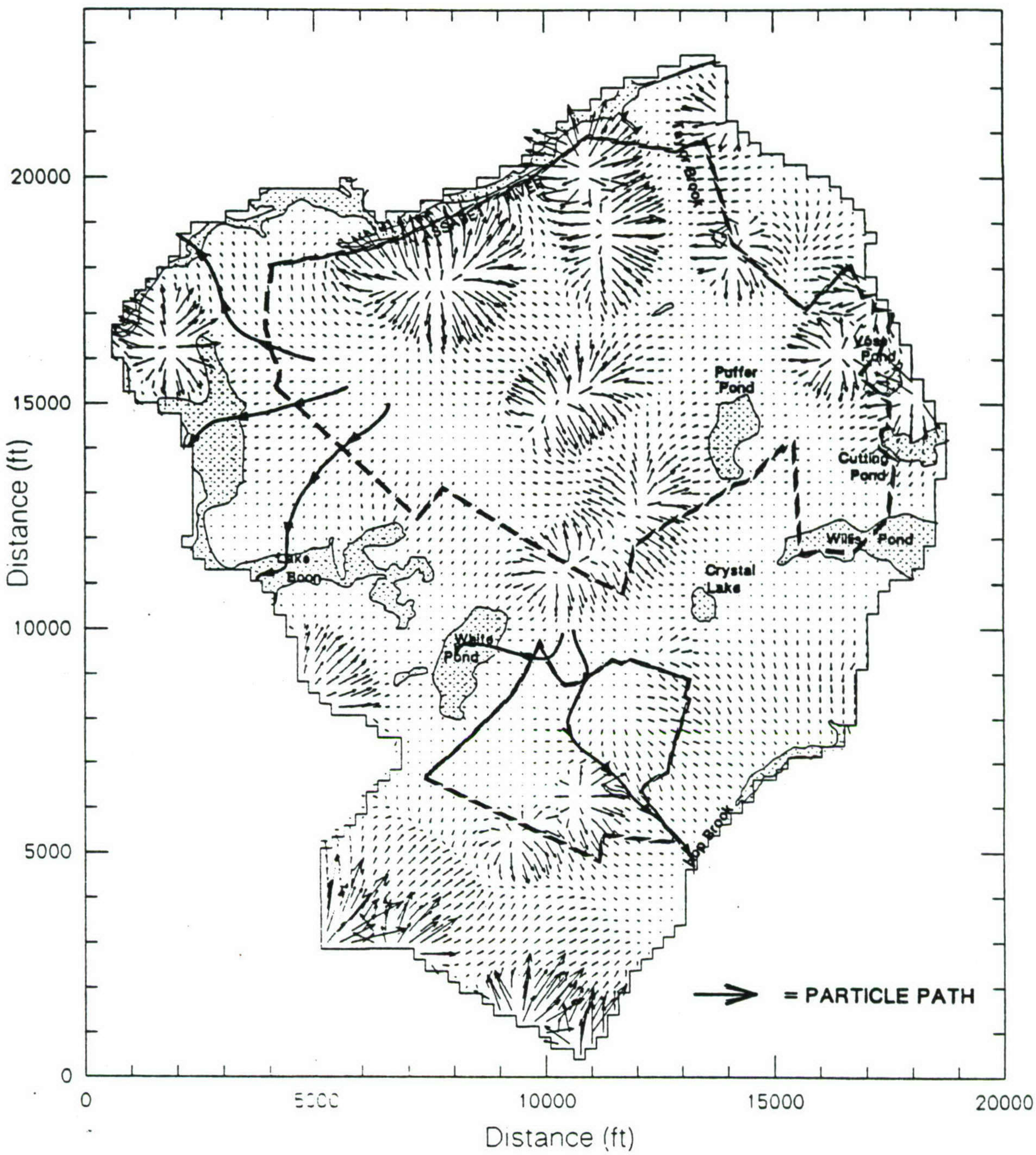


Figure 3.12 Example of particle travel paths in groundwater.

Streamflow rates within the modeled domain are reported for Marlboro Brook and Unnamed Brook by Perlmutter (1962). The locations of the gauging stations are shown in Figure 3.13. The measured daily mean discharge at the gauging stations is presented in Tables 3.1 and Table 3.2. The average monthly discharge at the Marlboro Brook gauging station varies from a low of 0.18 cubic feet per second (cfs) in July 1955 to a high of 1.3 cfs in April 1956. The average daily discharge for the 15 month period from April 1955 to June 1956 if 0.61 cfs. The model simulated discharge at the same location is 0.71 cfs. Measured discharge at the gauging station in Unnamed Brook varies from 0.07 cfs on August 15, 1955, to 0.22 cfs on May 9, 1955. The average daily discharge for the 7 days when measurements were taken in 1955 was 0.14 cfs. The model simulated daily discharge at the same location in Unnamed Brook is 0.13 cfs. The simulated discharge at both the locations compares well with the measured discharge, and is further indication of a well calibrated model.

The overall budget for the entire model is shown below:

	Cumulative Volume (ft^3)	
	IN	**OUT**
Storage	0.0	0.0
Constant Head	2977.0	9271.8
Wells	8.47E+05	0.0
River Leakage	2.85E+07	2.92E+07
Total	2.94E+07	2.93E+07

Percent Discrepancy = 0.43

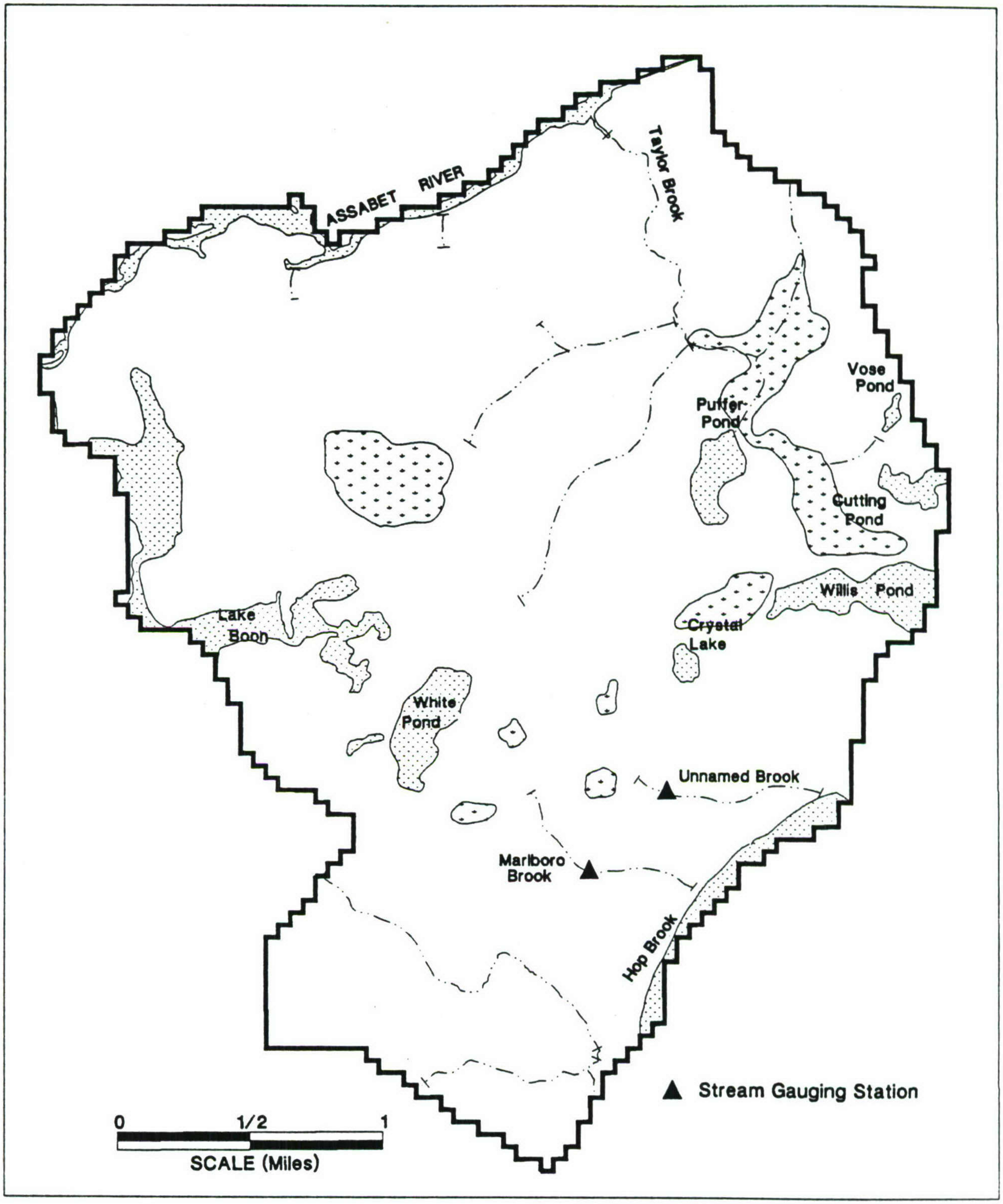


Figure 3.13 Location of gauging stations within modeled domain.

Daily mean discharge, in cubic feet per second, of Marlboro Brook, Maynard Ordnance Test Station, Massachusetts, for the period April 23, 1955, to June 30, 1956

Day	1955									1956					
	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
1	----------	0.66	0.43	0.19	0.14	[1] 0.75	[1] 0.50	0.78	0.54	[1] 0.31	0.52	0.52	0.69	1.10	0.88
2	----------	.60	.36	.26	.13	[1] .68	[1] .49	.68	.54	[1] .31	.55	.56	.80	1.02	.75
3	----------	.58	.32	.30	.13	[1] .64	[1] .48	.61	.54	[1] .31	.54	.70	.86	.98	.83
4	----------	.54	.31	.21	.13	[1] .60	[1] .47	.98	.66	[1] .31	.52	.91	1.03	.95	.88
5	----------	.54	.30	.19	.12	[1] .56	[1] .46	2.21	.77	[1] .30	.48	.81	1.51	.91	.73
6	----------	.57	.28	.22	.12	[1] .54	[1] .58	1.44	.61	[1] .30	.47	.71	1.77	.90	.67
7	----------	.54	.29	.25	.15	[1] .52	[1] .80	1.12	.56	[1] .30	.70	1.08	1.65	.88	.58
8	----------	.55	.28	.20	.15	[1] .50	[1] .60	.97	.52	[1] .30	.61	1.12	1.40	.83	.52
9	----------	.52	.28	.18	.13	[1] .48	[1] .50	.88	.51	[1] .30	.60	.91	1.39	.79	.52
10	----------	.47	.36	.20	.13	[1] .46	[1] .44	.83	.50	[1] .31	.60	.79	1.50	.78	.52
11	----------	.46	.25	.19	.14	.45	[1] .40	1.36	.47	[1] .32	.59	.79	1.64	.78	.50
12	----------	.44	.62	.17	.19	[1] .44	[1] .36	1.10	.46	[1] .36	.91	.78	1.64	.79	.47
13	----------	.42	.46	.17	.26	[1] .43	[1] .35	.91	.44	[1] .41	.79	.78	1.59	.76	.58
14	----------	.42	.34	.16	.23	[1] .43	[1] .35	1.20	.42	[1] .47	.71	.78	1.47	.75	.66
15	----------	.41	.29	.16	.16	[1] .42	1.12	1.04	.42	[1] .50	.74	.76	1.41	.73	.50
16	----------	.39	.26	.25	.15	[1] .42	1.31	.95	.41	[1] .53	.73	.73	1.75	.71	.72
17	----------	.38	.26	.21	.15	[1] .41	1.44	.91	.41	[1] .56	.66	.71	1.74	.63	.63
18	----------	.37	.23	.18	.72	[1] .41	1.00	.84	.40	[1] .58	.63	.68	1.44	.67	.50
19	----------	.36	.22	.18	7.04	[1] .41	.81	.76	[1] .39	[1] .60	.60	.66	1.31	.66	.45
20	----------	.35	.25	.16	[1] 2.50	[1] .42	.71	.75	[1] .38	[1] .61	.57	.64	1.20	.63	.42
21	----------	.34	.35	.16	[1] 1.50	[1] .41	.67	.71	[1] .36	.61	.56	.64	1.16	.61	.42
22	----------	.33	.40	.15	[1] 1.05	[1] .41	.63	.70	[1] .35	.61	.53	.66	1.10	.58	.41
23	0.44	.33	.26	.15	[1] 1.50	[1] .40	.57	.67	[1] .34	.61	.51	.72	1.17	.71	.38
24	.43	.32	.38	.17	[1] 1.45	[1] .58	.57	.64	[1] .33	.60	.50	.71	1.14	.73	.36
25	.64	.31	.35	.16	[1] 1.00	[1] .70	.58	.64	.37	.58	.58	.66	1.02	.64	.32
26	.76	.31	.28	.15	.88	[1] .55	.54	.63	.35	.56	.67	.61	.98	.63	.29
27	.76	.33	.24	.15	1.09	[1] .48	.52	.61	.34	.54	.61	.60	.97	.74	.29
28	.61	.30	.23	.14	.93	[1] .50	.50	.60	.33	.53	.66	.58	.96	.71	.29
29	1.04	.28	.22	.14	[1] .80	[1] .49	.50	.58	[1] .32	.52	.57	.58	1.35	.66	.29
30	.81	.28	.20	.14	[1] .75	[1] .48	.50	.56	[1] .32	.60	----------	.60	1.37	.63	.29
31	----------	.36	----------	.14	[1] .80	----------	1.09	----------	[1] .32	.58	----------	.61	----------	.82	----------
Total	5.49	13.04	9.20	5.68	24.62	14.97	19.84	26.66	13.68	14.33	17.71	22.39	39.01	23.76	15.65
Average	----------	0.42	0.31	0.18	0.79	0.50	0.64	0.89	0.44	0.46	0.50	0.72	1.30	0.77	0.52

[1] Estimated.

Table 3.1 Measured daily mean discharge at Marlboro Brook (Adapted from Perlmutter, 1962).

Miscellaneous discharge measurements, in cubic feet per second, of unnamed tributary, about 2,000 feet north of Marlboro Brook gaging station, 1955

Date	Discharge	Date	Discharge
April 29	0.20	August 15	0.07
May 9	.22	October 14	.12
June 17	.12	December 23	.21
July 19	.08		

Table 3.2 Measured daily mean discharge at Unnamed Brook (Adapted from Perlmutter, 1962).

3.7 SENSITIVITY ANALYSES

The process of calibration involves adjusting a number of key aquifer parameters in order to obtain a desired solution field, the interpreted water table surface. Although the calibrated parameters are within the range of acceptable and reported values, sensitivity analyses identifies critical aquifer parameters, thereby providing means for gauging the reliability of the model. Furthermore, sensitivity analyses also aids in planning and developing meaningful field studies for determining critical aquifer parameters. The response of the calibrated model to variations in the input parameters is discussed below.

3.7.1 Leakance

Sensitivity of the model to leakance between the glacial outwash and till units was first investigated by doubling and halving the leakance value between the two units. In either case, the impact on the calibrated water table was negligible. Similarly, the model was insensitive to the doubling and halving of leakance between the till and bedrock units.

3.7.2 Conductivity of the Lower two Modeled Units

The horizontal hydraulic conductivity of the two lowermost modeled units, which represents the till and bedrock formations, was doubled and halved both simultaneously and individually. For all cases, the change in the calibrated water table was insignificant. Therefore, as discussed earlier, these two units may be neglected for modeling purposes if the objective of the calibrated model is to reproduce the water table surface and simulate flow in the outwash.

3.7.3 Conductivity of the Topmost Modeled Unit

The topmost modeled unit represents the glacial outwash in most of the modeled domain except where the till and bedrock formations outcrop. The horizontal hydraulic conductivity in this layer was first reduced by 50 percent from the calibrated values. This resulted in a general increase in the water levels at the site. The resulting water table is presented in Figure 3.14. In the outcrops, the water levels increased by as much as 20 feet. This is to be expected since conductivity controls mounding in the outcrops. In the outwash, decreasing conductivity resulted

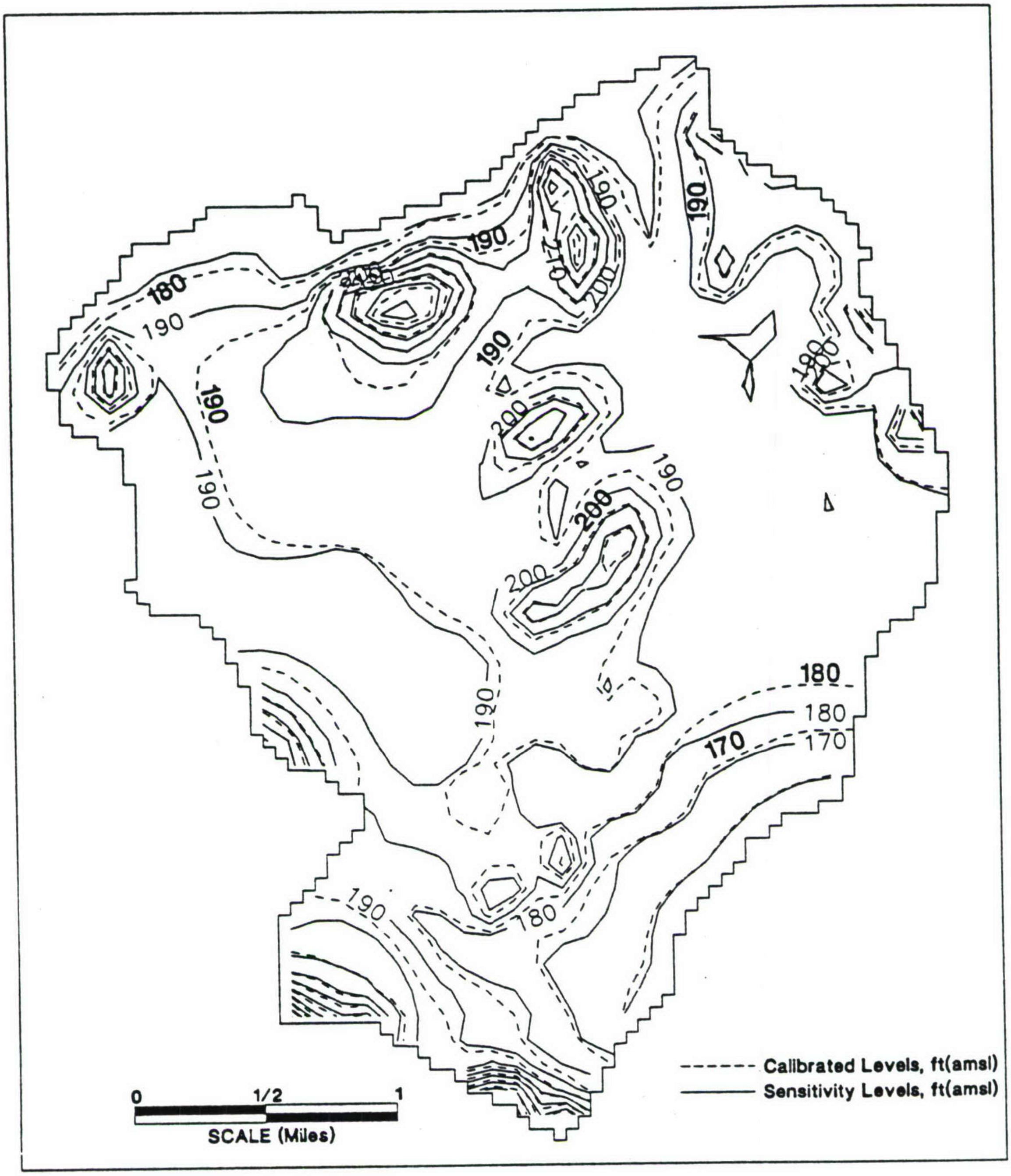


Figure 3.14 Water table for case with horizontal hydraulic conductivities in topmost modeled layer reduced 50 percent from calibrated values.

outcrops declined by about 15 feet, and the drop in the outwash varied from zero under the surface water bodies to less than 10 feet near the outcrops (Figure 3.15).

3.7.4 Recharge

The model was also very sensitive to the prescribed rate of infiltration. The calibrated rate of recharge was approximately 20 inches per year in the outwash and 10 to 15 inches per year in the outcrop. The overall recharge was first reduced by 50% from the calibrated values and as expected the water levels declined. However, since the head in the aquifer near the surface water bodies is controlled largely by the stage in the ponds/river, the change in water levels varies, remaining unchanged near the surface water features and declining up to 20 feet in the highland outcrops (Figure 3.16). Increasing recharge by 50%, as expected, had the opposite effect with water levels rising highest in the outcrops and staying approximately the same near ponds/rivers (Figure 3.17).

3.7.5 Varying Conductivity and Recharge Simultaneously

Since the watershed model of this study has no cross boundary flux or direct withdrawal from the subsurface, the steady-state groundwater flow in the domain may be expressed by:

$$\frac{\partial^2 h}{\partial n^2} + \frac{\partial^2 h}{\partial y^2} = \frac{R}{K}$$

This suggests that the hydraulic gradients and therefore the water levels are a function of the ratio of recharge (R) and horizontal conductivity (K).

A sensitivity run was conducted by doubling the calibrated recharge and conductivities in the outwash. As expected, the resulting water table (Figure 3.18) is nearly identical to the calibrated water table since the ratio $\left[\frac{R}{K}\right]$ remains unchanged from the calibrated base case.

Similarly, halving the recharge and conductivities in outwash resulted in a water table (Figure 3.19) almost identical to the calibrated case.

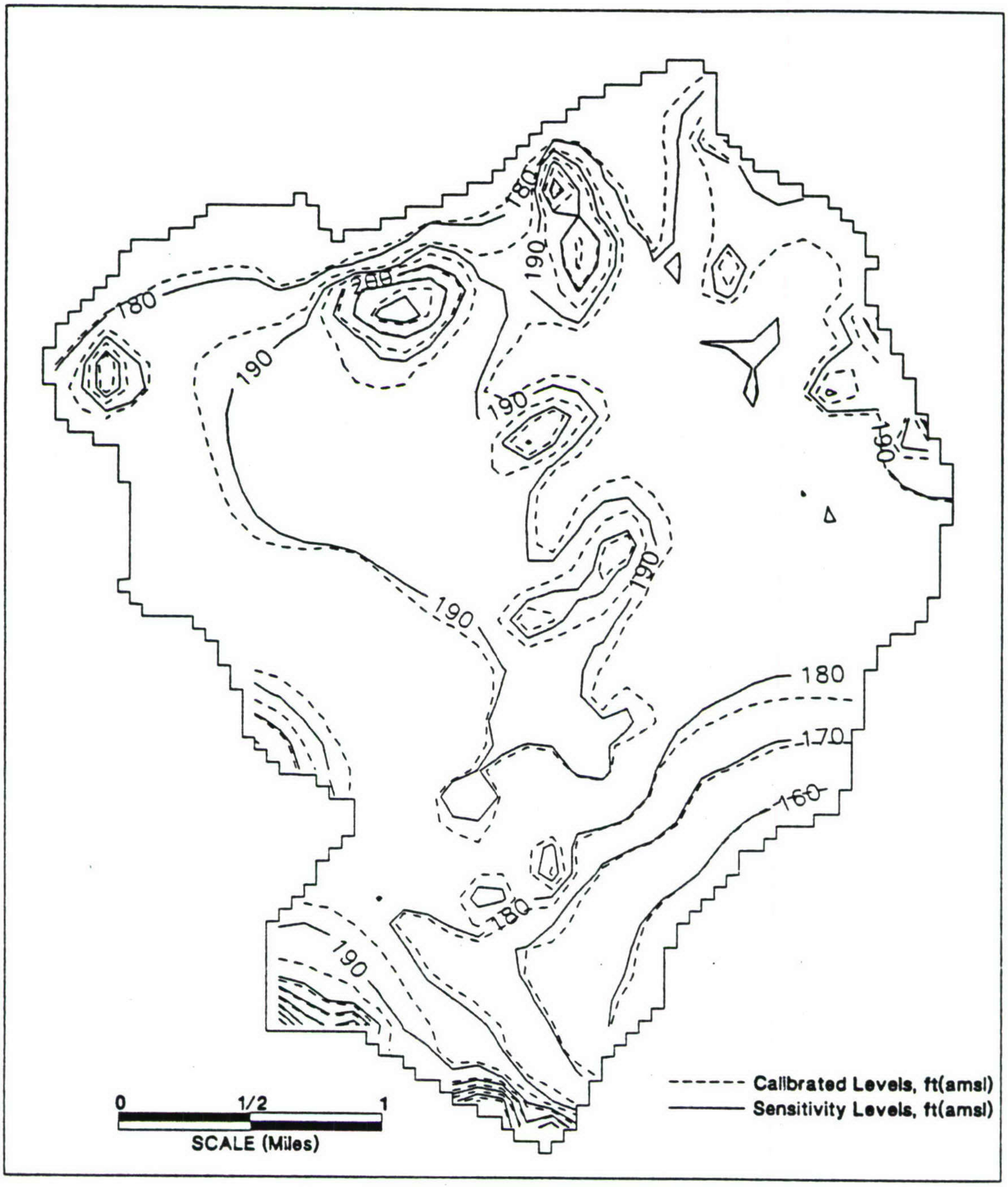


Figure 3.15 Water table for case with horizontal hydraulic conductivity in topmost modeled layer doubled from calibrated values.

Figure 3.16 Water table for case with areal recharge reduced 50 percent from calibrated values.

Figure 3.17 Water table for case with areal recharge increased 50 percent from calibrated values.

A sensitivity run was conducted by doubling the calibrated recharge and conductivities in the outwash. As expected, the resulting water table (Figure 3.18) is nearly identical to the calibrated water table since the ratio $\left[\frac{R}{K}\right]$ remains unchanged from the calibrated base case. Similarly, halving the recharge and conductivities in outwash resulted in a water table (Figure 3.19) almost identical to the calibrated case.

This implies that the calibrated water table may be reproduced if global variations to either the recharge or conductivities can be accompanied by a corresponding change to the other parameter. For example, if it is suggested that the actual rate of overall recharge is 25 inches rather than the calibrated value of 20 inches, then the calibrated water table may be replicated by increasing the conductivities by 25 percent. The rate of subsurface flow, however, depends only on the magnitude of recharge to the system.

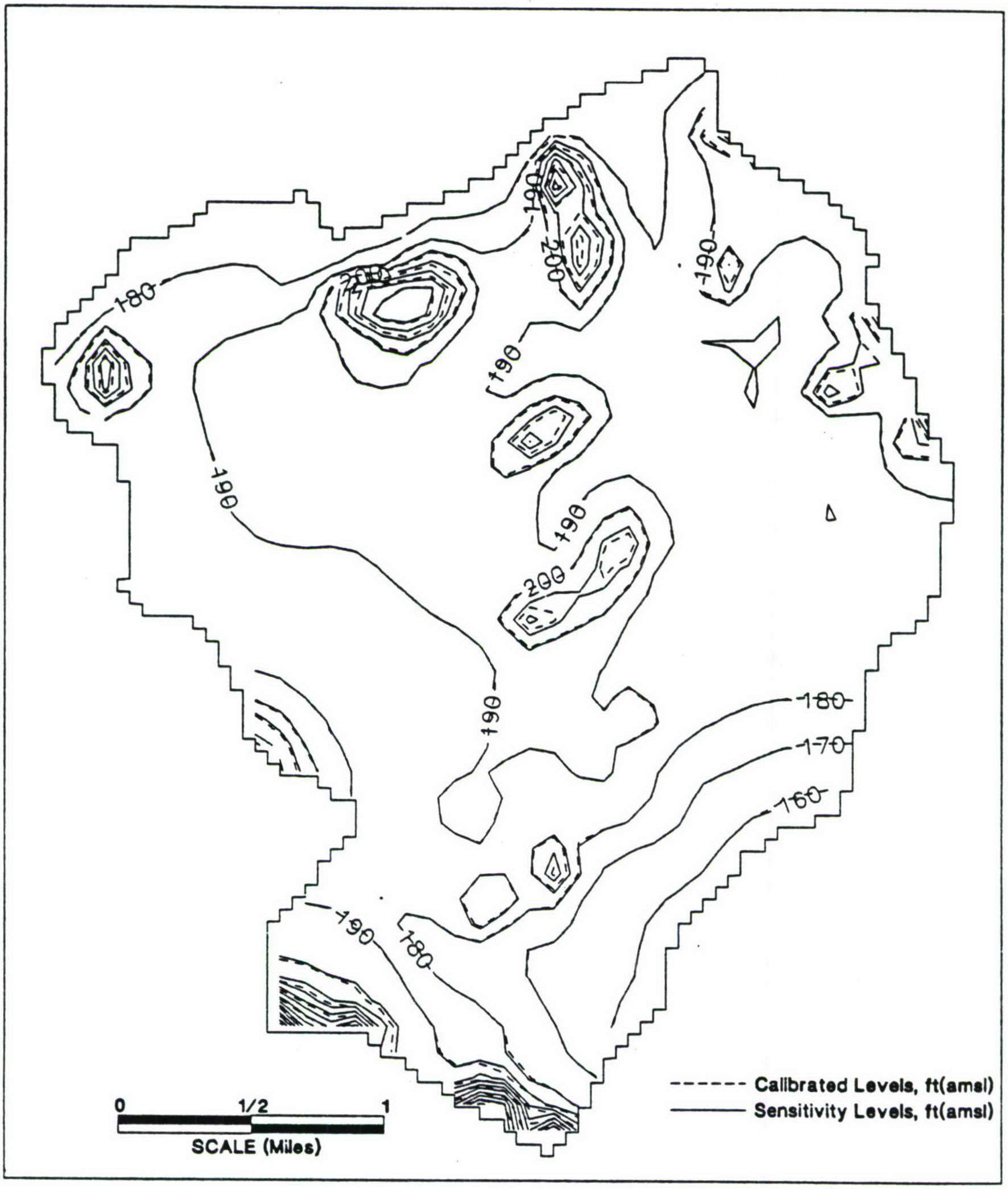


Figure 3.18 Water table for case with both areal recharge and horizontal conductivities in topmost layer doubled from calibrated values.

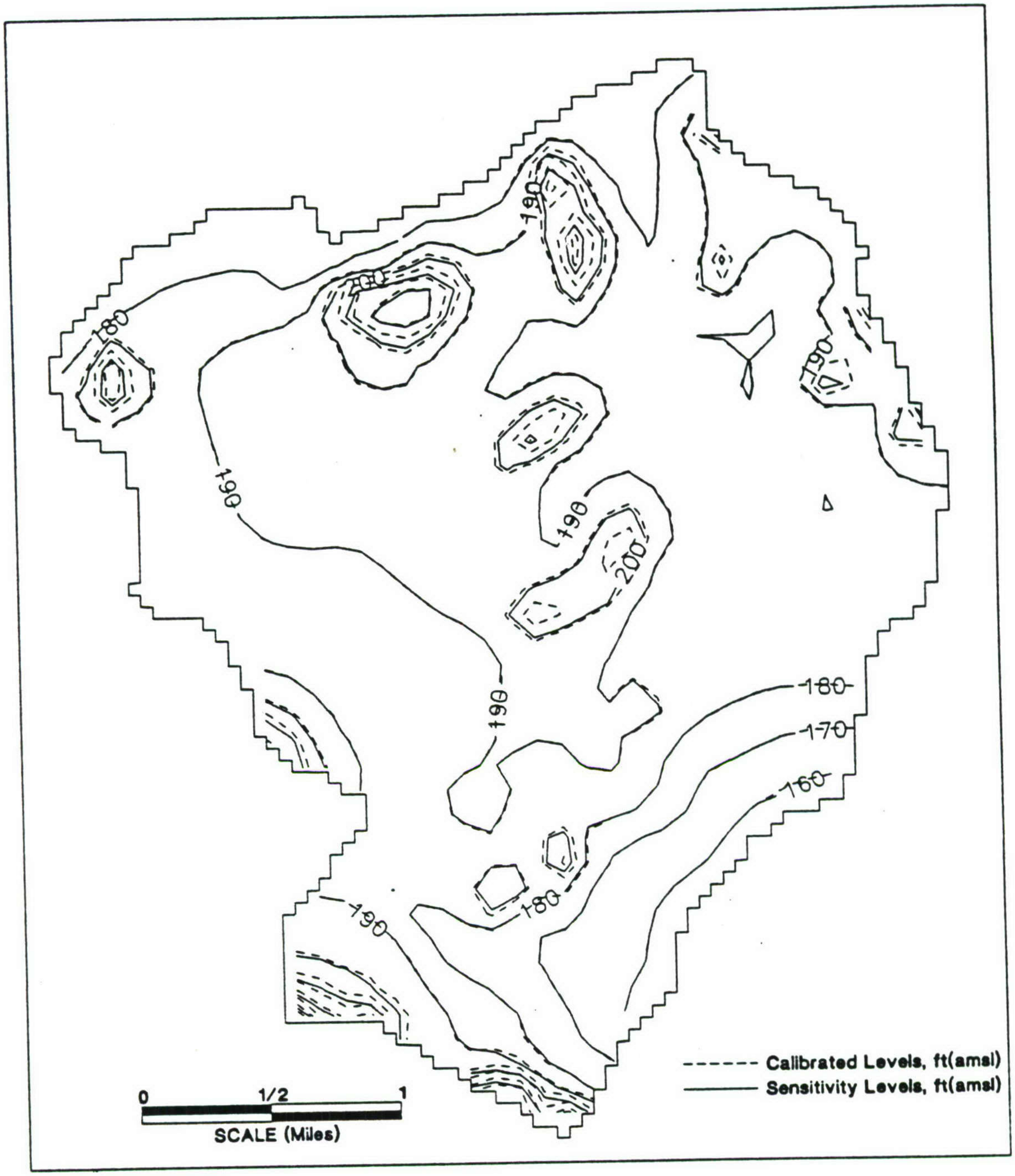


Figure 3.19 Water table for case with both areal recharge and horizontal conductivities in topmost modeled layer halved from calibrated values.

4.0 CONCLUSIONS

A groundwater model is developed which simulates subsurface flow through three geologic units at the Sudbury Training Annex and vicinity. The model accounts for hydraulic interaction between groundwater and surface water features at the site, and was calibrated to the long-term annual average water table.

The conceptual subsurface hydrodynamics at the site are confirmed by the model. Water enters the subsurface in the form of precipitation, recharging all three geologic units prior to discharging into the ponds, streams, and marshes at the site. The model delineates in detail the boundaries of all major and minor watersheds in the region. This will assist in future predictive and remedial investigative efforts. The model satisfactorily accounts for the contribution of groundwater to the estimated municipal withdrawal of surface water from White Pond by the Town of Maynard.

Aquifer parameters and boundary conditions were obtained or estimated after carefully reviewing all data sources pertinent to the site. The model was found to be significantly sensitive only to the ratio of areal recharge and horizontal hydraulic conductivities in the glacial outwash. Since there is good agreement between the interpreted and the calibrated water tables, and since the calibrated recharge to the model is well within the documented range, the model is considered well calibrated and capable of accurately simulating the direction and rate of flow in the subsurface. Therefore, the model should be useful for simulating the cumulative effects of multiple remedial actions and for providing boundary conditions for smaller scale models.

REFERENCES

Perlmutter, N.M., 1962. Groundwater Geology and Hydrogeology of the Maynard Area Massachusetts. US Geological Survey Water Supply Paper 1539-E.

Ecology and Environment, Inc., 1994. Fort Devens Sudbury Training Annex, Phase II Site Investigation Report, Vol. I, II and III. Prepared for U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland.

DuFrense-Henry, Inc., 1982. Report on Water Supply Investigation Tuttle Hill Area, Maynard, Massachusetts.

McDonald, M.G. and A.W. Harbaugh, 1988. A Modular Three-Dimensional Finite-Difference Groundwater Flow Model. Techniques of Water-Resources Investigations of the US Geological Survey, Book 6 Chapter A1.

Hansen, W.R., 1953, Late Tertiary and Pleistocene drainage changes in the Hudson and Maynard quadrangles, Massachusetts: Jour. Geology, v. 61, no. 4.

I

APPENDIX I

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

APPENDIX I

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Draft ARARs were developed for the Fort Devens Sudbury Training Annex by the Oak Ridge National Laboratory for use in establishing remedial goals for sites at the Annex. Section 7 in Volume I of this RI report provides a discussion of how ARARs were chosen. In addition, E & E identified the EPA Region III Risk-Based Concentrations (RBCs) as TBC guidance for soils, where ARARs do not exist. The three documents in this Appendix are:

1. Assessment of Location-Specific Applicable or Relevant and Appropriate Requirements (ARARs) for Fort Devens Sudbury Training Annex, Massachusetts, February 21, 1994.

2. Assessment of Chemical-Specific Applicable or Relevant and Appropriate Requirements (ARARs) for Fort Devens Sudbury Training Annex, Massachusetts, February 23, 1994.

3. A Memorandum with attached Risk-Based Concentration Table, Third-Quarter, 1994, Roy Smith, Senior Toxicologist, U.S. Environmental Protection Agency, Region III, July 11, 1994.

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U.S. ARMY ENVIRONMENTAL CENTER

ASSESSMENT OF LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) FOR FORT DEVENS SUDBURY TRAINING ANNEX, MASSACHUSETTS

REGULATORY DRAFT

February 21, 1994

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ASSESSMENT OF LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) FOR FT. DEVENS SUDBURY TRAINING ANNEX, MASSACHUSETTS

REGULATORY DRAFT

February 21, 1994

Chemical Hazard Evaluation Group
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ASSESSMENT OF LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) FOR FT. DEVENS SUDBURY TRAINING ANNEX, MASSACHUSETTS

1. INTRODUCTION

The assessment of applicable or relevant and appropriate requirements (ARARs) is an integral part of the remediation process mandated under the Comprehensive Environmental Response, Compensation and Liability Act and the Superfund Amendments and Reauthorization Act [42 U.S.C. §§ 9601-9675 (1991)]. As the preamble of CERCLA states, the purpose of the law is "to provide for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive hazardous waste disposal sites." In addressing hazardous substances and sites, CERCLA provides that on-site remedial actions must meet the standards and criteria that are otherwise legally applicable to the substance, pollutant, or contaminant **or** that are relevant and appropriate under the circumstances [42 U.S.C. § 9621(d)(2)(A) (1991)].

To this end, potential ARARs are identified as early as the Remedial Investigation/ Feasibility Study phase and refined throughout the process as a result of site characterization, the development, screening, and selection of remedial alternatives, and the remedial design and action. Guidance for assessing and selecting ARARs is provided in the U.S. Environmental Protection Agency's (U.S. EPA) manual "CERCLA Compliance With Other Laws" (USEPA 1988; USEPA 1989).

CERCLA remedial actions may trigger several different types of requirements or ARARs. These are organized, for convenience sake, into three categories; chemical-specific, action-specific, and location-specific. However, these categories are not always mutually exclusive and there may be some conceptual overlapping. Chemical-specific ARARs are health- or risk-based numerical values for different chemical substances (USEPA 1988). Action-specific ARARs are usually technology- or activity-based requirements or limitations (USEPA 1988). This report will specifically address the last category, the location-specific ARARS. These are restrictions or requirements for substances or activities based primarily on their specific physical location (USEPA 1988).

In order to be classified as an ARAR, a requirement must be applicable **or** relevant and appropriate. As defined in the National Contingency Plan (NCP), **applicable** requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site" [40 C.F.R. § 300.5 (1991)]. **Relevant and appropriate** requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not 'applicable' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" [40 C.F.R. § 300.5 (1991)].

In either case, an applicable or a relevant and appropriate requirement for on-site remedial action must be substantive. Compliance with administrative requirements is not mandated for on-site actions (USEPA 1988). Administrative requirements are those procedures "that facilitate the implementation of the substantive requirements of a statute or regulation" (USEPA 1988). For example, CERCLA specifically exempts on-site actions from federal, state and local permitting requirements [42 U.S.C. § 9621(e)(1) (1991)]. Furthermore, only those state requirements that are more stringent than federal requirements are ARAR [40 C.F.R. § 300.5 (1991)]. "More stringent" would also necessarily include those state laws or programs that have no federal counterpart as "they add to the Federal law requirements that are specific to the environmental conditions in the State" (USEPA 1989). State requirements must be adopted by formal means (i.e. promulgated) and generally applicable (i.e. not just to Superfund sites, but to all circumstances addressed in the requirement) [42 U.S.C. § 9621(d)(2)(C)(iii)(I) (1991)].

Finally, there is a category of requirements called "To Be Considered" (TBC) guidance that may appear in this document. These are guidelines or advisories that are issued by the federal or state government, but which are neither legally binding nor promulgated (USEPA 1988). However, these guidelines may be used when they are necessary to ensure protection of public health and the environment and when they have not been superseded (USEPA 1988). If no ARARs address a particular circumstance at a CERCLA site, or if the ARARs available do not ensure protectiveness, then TBCs can be used to establish remedial guidelines or targets.

2. LOCATION-SPECIFIC ARARs

Table 1 lists the major federal and Commonwealth location-specific ARARs that might be pertinent to remedial actions at Fort Devens Sudbury Training Annex (Sudbury Annex). TBC guidance is addressed, where appropriate, in the text only.

2.1. Faults

Sudbury Annex is located near the western boundary of the Seaboard Lowland Section of the New England-Maritime Physiographic Province (EEI 1993). This area is characterized by glacial deposits underlain by a complex of metamorphic and igneous rock in tightly-folded bedrock units (EEI 1993). There are numerous faults in the area of Sudbury Annex (Foster 1994). However, they generally date to the early-Paleozoic period and there are no faults with Holocene displacement under the facility or in its vicinity (Foster 1994). The area has experienced a number of major earthquakes since the early 1700's that, while not involving fault displacement, have involved liquification of sediments (Sinnott 1992). Interestingly, earthquakes in the eastern part of the country are not associated with faults, as are those in the western United States (Oldale 1993). Rather, they are deep seated in the crust and there is, in fact, a significant earthquake potential in the northeastern United States (Oldale 1993).

Under current RCRA regulations, Sudbury Annex is exempted from compliance with the RCRA seismic requirements of 40 C.F.R. § 264.18 (1992) since § 264.18(a) stipulates that all facilities located within political jurisdictions other than those listed in Appendix VI are assumed to be in compliance for location of new treatment, storage or disposal (TSD) facilities. Massachusetts is not listed in the Appendix. EPA had intended to propose additional restrictions for location of TSD facilities; however, the rule has been put on hold because the Office of Management and Budget disagreed with the basic premise of the rule. If additional restrictions are proposed, they will be evaluated for their relevance to remedial actions at Sudbury Annex.

TABLE 1. Tentative Location-Specific Applicable or Relevant and Appropriate Requirements for FDSTA

Location Characteristic(s)	Operating Condition(s)	Requirement(s)	Citation(s)
Floodplains			
· Within 100-year floodplain	· Treatment, storage or disposal facility · RCRA[a]-defined listed or characteristic hazardous waste [40 C.F.R. § 261 (1992)] -or- RCRA-permitted facility	· Facility must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by 100 year flood.	· 40 C.F.R. § 264.18(b) (1992)
· Within "lowland and relatively flat areas adjoining inland and coastal waters and other floodprone areas such as offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year." [Executive Order 11988 § 6(c) and 40 C.F.R. § 6, Appendix A § 4(d) (1992)]	· Federal agency action which involves: - acquiring, managing, and disposing of lands and facilities - providing federally undertaken, financed, or assisted construction and improvements - conducting federal activities and programs affecting land use	· Federal agencies shall take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health and welfare, and restore and preserve the natural and beneficial values of floodplains. · Federal agencies shall evaluate potential effects of actions in floodplains and ensure consideration of flood hazards and floodplain management. · If action is taken in floodplains, federal agencies shall consider alternatives to avoid adverse effects, incompatible development, and minimize potential harm.	· Executive Order 11988 · 40 C.F.R. § 6.302(b) (1992) · 40 C.F.R. § 6, Appendix
· Inland and coastal land subject to flooding	· Treatment, storage or disposal facility subject to regulations under Mass. Regs. Code[b] tit. 310, § 30.800 (1989)	· Active portions of new treatment or storage facilities are prohibited within the boundary of land subject to flooding from the statistical 100-year frequency storm. · Active portions of landfills, land treatment units, surface impoundments, or waste piles are prohibited within the boundary of land subject to flooding from the statistical 500-year frequency storm.	· Mass. Regs. Code tit. 310, § 30.701(6) (1989)
· Inland and coastal land subject to flooding from the statistical 500-year frequency storm	· Landfills, land treatment unit, surface impoundment, or waste pile subject to regulation under Mass. Regs. Code tit. 310, § 30.800 (1989)	· Active portion of landfills, land treatment units, surface impoundments, or waste piles are prohibited within the boundary of land subject to flooding from the 500-year frequency storm.	· Mass. Regs. Code tit. 310, § 30.701(6) (1989)

Location Characteristic(s)	Operating Condition(s)	Requirement(s)	Citation(s)
· Land subject to flooding as defined in Mass. Regs. Code tit. 310, § 10.57(2) (1989)	· Activities within the area subject to flooding which involve removal, filling, dredging, or alteration of the area, as defined in Mass. Regs. Code tit. 310, § 10.04 (1989). · Activities within 100 feet of land subject to flooding which would alter the area.	· Actions in "bordering land subject to flooding" shall provide compensatory storage for flood storage volume lost as a result of the project, shall not restrict flows so as to cause an increase in flood stage or velocity, and shall not impair its capacity to provide important wildlife habitat functions or alter vernal pool habitat. · Actions in "isolated land subject to flooding" shall not result in flood damage because of lateral displacement of water that would otherwise be confined within the area, adverse effects on water supply or ground water supply, adverse effects on the capacity of the area to prevent ground water pollution, or adverse effects on vernal pool habitat.	· Mass. Gen. L.ᶜ ch. 131, § 40 (1990) · Mass. Regs. Code tit. 310, §§ 10.00-10.60 (1989)
Wetlands			
· Presence of wetlands as defined in Executive Order 11990, § 7(c) and 40 C.F.R. § 6, Appendix A, § 4(j) (1992)	· Federal agency action which involves: - acquiring, managing, and disposing of lands and facilities - providing federally undertaken, finances, or assisted construction and improvements - conducting federal activities and programs affecting land use	· Whenever possible, federal agency actions must avoid or minimize adverse impacts on wetlands and act to preserve and enhance their natural and beneficial values. Agencies should particularly avoid new construction in wetlands areas unless there are no practicable alternatives. · Federal agencies shall incorporate wetlands protection considerations into planning, regulating, and decision-making processes.	· Executive Order 11990 · 40 C.F.R. § 6.302(a) (1992) · 40 C.F.R. § 6, Appendix A (1992)
· Presence of wetlands as defined in 40 C.F.R. § 230.3(t) (1992) and 33 C.F.R. § 328.3(b)*	· Action involving discharge of dredge or fill material into wetlands	· Action must be taken to avoid degradation or destruction of wetlands to the extent possible. Discharges for which there are practicable alternatives with less adverse impacts or those which would cause or contribute to significant degradation are prohibited. · If adverse impacts are unavoidable, action must be taken to enhance, restore, or create alternative wetlands.	· Clean Water Act § 404 [33 U.S.C. § 1344 (1991)] · 40 C.F.R. § 230 (1992) · 33 C.F.R. §§ 320-330*

Location Characteristic(s)	Operating Condition(s)	Requirement(s)	Citation(s)
· Presence of wetlands as defined in Mass. Gen. L. ch. 130, § 105 (1990) or Mass. Gen. L. ch. 131, § 40 (1990), or regulations pursuant to those statutes	· Landfills, land treatment unit, surface impoundment, or waste pile subject to regulation under Mass. Regs. Code tit. 310, § 30.800 (1989) · Hazardous waste subject to regulation under Mass. Regs. Code tit. 310, § 30.000 (1989)	· Active portions of designated facilities cannot be constructed in, or expanded into, wetlands.	· Mass. Regs. Code tit. 310, § 30.705(6) (1989)
· Presence of any bank, freshwater wetland, coastal wetland, beach, dune, flat, marsh, meadow, or swamp bordering on the ocean or on any estuary, creek, river, stream, pond, or lake **or** any land under these waters **or** land subject to tidal action, coastal storm flow, or flooding	· Activities within a protected area which involve removal, filling, dredging, or alteration of the area · Activities within 100 feet of a protected area which would alter the area.	· Removal, filling, dredging, or alteration of protected area is prohibited except under the conditions and criteria delineated in Mass. Regs. Code tit. 310, §§ 10.00-10.60 (1989).	· Mass. Gen. L. ch. 131, § 40 (1990) · Mass. Regs. Code tit. 310, §§ 10.00-10.60 (1989)
· Presence of any bank, freshwater wetland, coastal wetland, beach, dune, flat, marsh, meadow, or swamp bordering on the ocean or on any estuary, creek, river, stream, pond, or lake **or** any land under these waters **or** land subject to tidal action, coastal storm flow, or flooding	· Activities within a protected area which involve removal, filling, dredging, or alteration of the area · Activities within 100 feet of a protected area which would alter the area.	· Removal, filling, dredging, or alteration of protected area is prohibited except under the conditions and criteria delineated in Mass. Regs. Code tit. 310, §§ 10.00-10.60 (1989). - **Applicable**	· Mass. Gen. L. ch. 131, § 40 (1990) · Mass. Regs. Code tit. 310, §§ 10.00-10.60 (1989)
Wilderness areas, wildlife resources, wildlife refuges, or scenic rivers			
· Within area affecting stream or river - **and**- presence of fish or wildlife resources	· Action which results in the control or structural modification of a natural stream or body of water	· The effects of water-related projects on fish and wildlife resources must be considered. · Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. · Off-site actions which alter a resource require consultation with the FWS[d], NMFS[e], and/or the appropriate state agency. · Consultation with the responsible agency is also strongly recommended for on-site actions.	· Fish and Wildlife Coordination Act (16 U.S.C. § 661*) · 40 C.F.R. § 6.302(g) (1992)
· Location encompassing aquatic ecosystem with dependent fish, wildlife, other aquatic life, or habitat	· Action involving the discharge of dredge or fill material into aquatic ecosystem	· Degradation or destruction of aquatic ecosystems must be avoided to the extent possible. Discharges which cause or contribute to significant degradation of the water of such ecosystem are prohibited.	· Clean Water Act § 404 [33 U.S.C. § 1344 (1991)] · 40 C.F.R. § 230(1992) · 33 C.F.R. §§ 320-330*

Location Characteristic(s)	Operating Condition(s)	Requirement(s)	Citation(s)
· Presence of areas such as wetlands, etc., as listed in Mass. Regs. Code tit. 310, § 10.02(1) 1989), which due to their plant community composition and structure, hydraulic regime, or other characteristics, provide important food, shelter, migratory or overwintering areas, or breeding areas for wildlife	· Activities within a protected area which involve removal, filling, dredging, or alteration of the area · Activities within 100 feet of a protected area which would alter the area.	· Actions which would have adverse effects on specific habitat characteristics and the important functions they serve are prohibited or regulated if they exceed certain threshold levels delineated in the regulations.	· Mass. Gen. L. ch. 131, § 40 (1990) · Mass. Regs. Code tit. 310, §§ 10..00-10.60 (1989)
Endangered, threatened or rare species			
· Presence of endangered or threatened species, or critical habitat (see above citation) of same, within an aquatic ecosystem as defined in 40 C.F.R. § 230.3(c) (1992)	· Action involving discharge of dredge or fill material into aquatic ecosystem	· Dredge or fill material shall not be discharged into an aquatic ecosystem if it would jeopardize such species or would likely result in the destruction or adverse modification of a critical habitat of the species.	· Clean Water Act § 404 [33 U.S.C.§ 1344 (1991)] · 40 C.F.R. § 230.10(b) (1992)
· Presence of endangered or threatened species -or- critical habitat of such species as designated in 50 C.F.R. § 17 (1989), 50 C.F.R. § 226 (1989), or 50 C.F.R. § 227 (1989)	· Action which is likely to jeopardize species or destroy or adversely modify critical habitat	· Actions which jeopardize species/habitat must be avoided or appropriate mitigation measures taken. · Off-site actions which affect species/habitat require consultation with DOI', FWS, NMFS, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. · Consultation with the responsible agency is also strongly recommended for on-site actions.	· Endangered Species Act of 1973 (16 U.S.C. §§ 1531-1543*) · 50 C.F.R. § 402 (1989) · 40 C.F.R. § 6.302(h) (1992) · Fish and Wildlife Coordination Act (16 U.S.C. § 661*)
· Presence of significant habitats of state-listed species as designated pursuant to Mass. Gen. L. ch. 131A (1991)	· Action likely to alter significant habitat	· Actions which alter significant habitat are prohibited if the alteration will likely reduce the viability of a significant habitat.	· Mass. Gen. L. ch. 131A (1991) · Mass. Regs. Code tit. 321, §§ 10.00-10.61 (1992)
· Presence of a protected resources area, as designated in Mass. Regs. Code tit. 310, § 10.02(1) (1989), which is part of the habitat of a state-listed species	· Activities within a protected area which involve removal, filling, dredging, or alteration of the area · Activities within 100 feet of a protected area which would alter the area.	· Short or long term adverse effects on the habitat of the local population of the listed species are prohibited.	· Mass. Gen. L. ch. 131, § 40 (1990) · Mass. Regs. Code tit. 310, 10.00-10.60 (1989)

Location Characteristic(s)	Operating Condition(s)	Requirement(s)	Citation(s)
Archaeological and historic resources			
· Presence of archaeological or historic resources	· Action involving dam construction or other alteration of terrain which might cause irreparable loss or destruction of significant scientific, prehistoric, historic, or archaeological data	· The Secretary of the Interior must be advised of the presence of such data. · A survey must be conducted of affected areas for resources and data. Steps must be taken to recover, protect, and preserve data therefrom or DOI formally requested to do so.	· Archaeological and Historic Preservation Act [16 U.S.C. §§ 469(a)-469(c)*] · 40 C.F.R. § 6.301 (1992) · 32 C.F.R. § 650.181*
· Presence of federally owned, administered, or controlled prehistoric or historic resources -or- the likelihood of undiscovered resources		· Cultural resources included on, or eligible for inclusion on, the National Register of Historic Places (36 C.F.R. § 60*) or National Historic Landmark Program (36 C.F.R. § 65*) must be identified. · A determination must be made as to whether proposed action(s) will affect such resources and, if so, alternatives to the action(s) must be examined and considered. · When alteration or destruction of the resource is unavoidable, steps must be taken to minimize or mitigate the impacts and to preserve records and data of the resource. · When all or part of a remedial action is off-site, the consultation requirements of 16 U.S.C. § 470(f)* must be completed. · Consultation is also strongly recommended for on-site actions.	· National Historic Preservation Act [16 U.S.C. §§ 470(a)-470(w)* · Executive Order 11593 · 40 C.F.R. § 6.301 (1992) · 36 C.F.R. § 800* · 32 C.F.R. § 650.181*

[a]RCRA = Resource Conservation and Recovery Act; definitions appear at 40 CFR 260.10
[b]Mass. Regs. Code = Code of Massachusetts Regulations
[c]Mass. Gen. L. = Massachusetts General Laws
[d]FWS = U. S. Fish and Wildlife Service
[e]NMFS = National Marine Fisheries Service
[f]DOI = Department of Interior

2.2. Caves, salt-dome formations, salt-bed formations, and underground mines

Sudbury Annex is located in north central Massachusetts in Middlesex County and includes areas within the towns of Maynard, Hudson, Marlboro, Stow, and Sudbury. The installation is divided into a larger, northern section (upper section) and a smaller, southern section (lower section) by Hudson Road. The terrain is broad flat plains with scattered hills along the northern edge of the upper section, concentrating primarily in the north-central area (EEI 1993). The hilly portions consist of glacial till, with glacial outwash comprising the flat areas (EEI 1993). There are no salt formations or caves on Sudbury Annex (Foster 1994). In addition, there are no underground mines at the installation. (Foster 1994). Therefore, no ARARs developed under this location-specific category.

2.3. Floodplains and wetlands

There are abundant surface water resources on and around Sudbury Annex. The Assabet River flows adjacent to the northwestern side of the upper section (EEI 1993). Puffer Pond is located in the east central part of the upper section with Willis Pond straddling on both sides of the eastern boundary of that section. Cutting Pond and Vose Pond are located just beyond the eastern boundary, to the north of Willis Pond (EEI 1993). Crystal Lake is situated southeast of the upper section of Sudbury Annex and northeast of the lower section. White Pond and Lake Boon are just beyond installation boundaries, south/southwest of the upper section and west/northwest of the lower section. White Pond is a source of water supply for the Town of Maynard (EEI 1993). Maps of Sudbury Annex also show several small, unnamed waterbodies in the central and north-central portion of the upper section and in the eastern portion of the lower section (EEI 1993).

In addition to the open waterbodies listed above, the Assabet River flows along the northwestern border of the upper section of Sudbury Annex. There are also a number of perennial and intermittent streams on the installation (EEI 1993). Taylor Brook flows northward across the upper portion of Sudbury Annex and, along with its tributaries, drains that section of the installation into the Assabet River (EEI 1993). The western and southwestern portions of the upper section drain into White Pond and Lake Boon (EEI 1993). Marlboro Brook flows east across the lower section of the installation into Hop Brook just east of Sudbury Annex.

As might be expected, given the abundant water resources on and around Sudbury Annex, there are floodplains associated with the river (EEI 1993). It is also likely that there are floodplains associated with the streams and ponds on the installation; however, a survey or summary is not available. Additionally, the various state and federal laws addressing floodplains entail varying definitions of the resources covered under their provisions. Therefore, particular attention should be paid to the definitions and jurisdictional requirements of each statute and/or regulation.

Remedial actions that impact floodplains, depending on the particulars of the action and the location, could be subject to requirements under 40 C.F.R. § 264.18(b) (1992), Executive Order 11988, 40 C.F.R. § 6.302(b) (1992), and 40 C.F.R. § 6, Appendix A (1992). TSD facilities, landfills, land treatment units, surface impoundments, and waste piles which impact inland or coastal land subject to flooding are regulated under Mass. Regs. Code tit. 310, § 30.701(6) (1989) which would also be ARAR if the remedial action taken fall within its perview. The removal, dredge, fill, or alteration of land subject to flooding is addressed at Massachusetts General Laws (Mass. Gen. L.) ch. 131, § 40 (1990) and Mass. Regs. Code tit. 310, §§ 10.00-10.60 (1989). These

regulations would be applicable to actions that impact "bordering land subject to flooding" and "isolated land subject to flooding." The definitions, critical characteristics, and boundaries of protected areas are delineated in Mass. Regs. Code tit. 310, § 10.57(2) (1989). Assistance in addressing these Commonwealth provisions may be found in the Wetlands Protection Program Policy 85-2, "Isolated Land Subject to Flooding." Wildlife resources and rare species are also addressed under Mass. Regs. Code tit. 310, §§ 10.00-10.60 (1989). However, those provisions will be examined in more detail under sections 2.4 and 2.5 of this document.

Given that 81% of Sudbury Annex is characterized as lowlands, it is not surprising that there are numerous wetlands scattered over much of the installation (EEI 1993; Aneptek 1991). A complete description of all of these resources is beyond the scope of this text, but resource material is readily available and includes the National Wetlands Inventory Maps, the *Master Environmental Plan - Fort Devens Sudbury Training Annex, Sudbury , Massachusetts* (EEI 1993), and the *U.S. Army Natick Research, Development and Engineering Center Endagered Species Survey - Phase I: An Environmental Inventory of Wildlife Species and Their Habitats* [(See particularly Section 5 - U.S. Army Fort Devens Sudbury Annex - Taylor Drop Zone and Section 6 - Hudson (Capeheart Housing Area (lower section Sudbury Annex)] (Aneptek 1991). Briefly, the most common types of wetlands include bottomland hardwood forests along the river floodplains and the edges of water bodies, shrub swamps, which tend to be fairly stable, and freshwater emergent marshes (EEI 1993; Aneptek 1991). The latter are particularly important for waterfowl (EEI 1993).

Any remedial activities that impact wetlands may develop applicable requirements under Executive Order 11990, 40 C.F.R. § 6.302(a) (1992), 40 C.F.R. § 6, Appendix A (1992), the Clean Water Act § 404 [33 U.S.C. § 1344 (1991)], 40 C.F.R. § 230 (1992), and 33 C.F.R. §§ 320-330 (1992). Massachusetts regulations located at Mass. Regs. Code tit. 310, § 30.705(6) (1989) prohibit location of the active portion of a landfill, land treatment unit, surface impoundment, or waste pile within a wetland and Mass. Regs. Code tit. 310, § 16.40(3) (1990) prohibit the location of a solid waste landfill within a resource area protected by the Wetlands Protection Act. For the purposes of these regulations wetlands are defined according to Mass. Gen. L. ch. 130, § 105 (1990), Mass. Gen. L. ch. 131, § 40 (1990), and the regulations promulgated pursuant to those statutes. Any activities involving dredging, filling, removal, or alteration of wetlands, wet meadows, etc. would also be subject to requirements under the Wetland Protection Act, Mass. Gen. L. ch. 131, § 40 (1990), and the Wetlands Protection Regulations at Mass. Regs. Code tit. 310, §§ 10.00-10.60 (1989).

While these latter Commonwealth requirements regulate the same activities as the federal requirements in and pursuant to the Clean Water Act, they are "stricter" in that they address protection to a wider variety of resources, including wetlands, banks, dunes, etc. [see Mass. Regs. Code tit. 310, § 10.02(1) (1989)]. In addition, the regulations restrict activities within 100 feet of the wetland or other resource, in the "Buffer Zone," and provide protection for wildlife resources and rare species. These regulations are very comprehensive and a complete analysis of their provisions is beyond the scope of this document. They should be carefully reviewed and to the extent that the coverage of the regulations are broader than the federal counterpart, they would be applicable for actions subject to the regulations that impact protected resources. Assistance in addressing these regulations may be found in Wetlands Protection Program Policy 85-1, "Interpretation of Identified Vegetation," and Wetlands Protection Program Interim Guidance 90-TG1, "Aquatic Plant Control."

2.4. Wilderness areas, wildlife refuges, wildlife resources, scenic rivers

There are no scenic rivers, wildlife refuges or wilderness areas on Sudbury Annex, or within impact range of the installation. However, Sudbury State Forest is located just outside the southern edge of the upper section of the installation, between that portion and the lower section (EEI 1993; Aneptek 1991). If any remedial activities appear likely to impact this resource, the appropriate state official and/or management personnel should be contacted for guidance as to any requirements.

Given the natural resources and habitats on Sudbury Annex, the presence of wildlife resources is predictable. Sources for more detailed descriptions include the *Master Environmental Plan - Fort Devens Sudbury Training Annex, Massachusetts* (EEI 1993) and the *U.S. Army Natick Research, Development and Engineering Center Endagered Species Survey - Phase I: An Environmental Inventory of Wildlife Species and Their Habitats* [(See particularly Section 5 - U.S. Army Fort Devens Sudbury Annex - Taylor Drop Zone and Section 6 - Hudson (Capeheart Housing Area (lower section Sudbury Annex)] (Aneptek 1991). Particular note should be taken of the presence of, and the potential for, vernal pool habitats on Sudbury Annex (EEI 1993; Aneptek 1991).

Any remedial activity that results in the control of a natural stream or water body with fish or wildlife resources may be subject to applicable requirements under the Fish and Wildlife Coordination Act (16 U.S.C. § 661 (1992)) and 40 C.F.R. § 6.302(g) (1992). Any action involving the discharge of dredge or fill material into an aquatic ecosystem with dependant fish, wildlife, other aquatic life, or habitat would dictate consideration of the Clean Water Act § 404 [33 U.S.C. § 1344 (1991), 40 C.F.R. § 230 (1992), and 33 C.F.R. §§ 320-330 (1992). Remedial activities involving removal, alteration, dredging or filling, of wetlands, lands subject to flooding, and various other areas would also implicate applicable requirements under Mass. Gen. L. ch. 131, § 40 (1990) and Mass. Regs. Code tit. 310, §§ 10.00-10.60 (1989), which provide protection for certain wildlife habitats that provide important food, shelter, migratory or overwintering areas, or breeding areas for wildlife. Vernal pool habitats receive special consideration under these regulations and there are certain thresholds established for impacts in other areas. The Massachusetts regulations are very comprehensive and should be reviewed in detail if protected resources are identified in any location where remedial activities will occur. Assistance in this process may be found in Wetlands Protection Program Policy 88-1, "Inland Wildlife Habitats," Wetlands Protection Program Policy 88-5, "Wetlands Wildlife Advisory," and Wetlands Protection Program Interim Guidance 90-TG1, "Aquatic Plant Control."

2.5. Rare, threatened, or endangered species

Recent studies and observations at Sudbury Annex have identified a number of rare, threatened, or endangered species at the installation (EEI 1993; Aneptek 1991). A list of rare, threatened, and endangered species is provided in Table 2-5 of the *Master Environmental Plan - Fort Devens Sudbury Training Annex* (EEI 1993). There is some controversy regarding the grass-leaved Ladies' Tress (*Spiranthes Vernalis*), a state species of special concern. This species was documented by Aneptek during an endangered species survey that included portions of Sudbury Annex, specifically the Taylor Drop Zone and the Hudson (Capeheart) Housing Area (lower portion) (Aneptek 1991). Apparently, the presence of the plant was disputed by a later survey (EEI 1993).

If any rare, threatened, or endangered species are impacted by remedial activities at Sudbury Annex, applicable requirements may develop under the Endangered Species Act of 1973 (16 U.S.C. §§ 1531-1543 (1992), 50 C.F.R. § 17 (1989), 50 C.F.R. § 402 (1989), 40 C.F.R. § 6.302(h) (1992), and the Fish and Wildlife Coordination Act (16 U.S.C. § 661 (1992)). Moreover, any activity involving the discharge of dredge or fill material into an aquatic ecosystem would invoke the provisions of the Clean Water Act § 404 [33 U.S.C. § 1344 (1991) and 40 C.F.R. § 230.10(b) (1992) as applicable requirements. Mass. Regs. Code tit. 310, § 16.40 (4)(c) (1990) prohibit the location of a solid waste landfill in an area that would have an adverse impact on an endangered, threatened, or special concern species or on an ecologically significant natural community listed by the Natural Heritage and Endangered Species Program. The Massachusetts Wetlands Protection Act (Mass. Gen. L. ch. 131, § 40 (1990) and its regulations (Mass. Regs. Code tit. 310, §§ 10.00-10.60 (1989) provide requirements that would apply if a remedial activity alters a protected resources area [see Mass. Regs. Code tit. 310, § 10.02 (1989)] that is part of the estimated habitat of a rare species. "Estimated Habitat Maps" for rare state-listed species are available from the Massachusetts Natural Heritage and Endangered Species Program. Assistance in addressing these Commonwealth regulations may be found in Wetlands Protection Program Policy 90-2, "Rare Species Habitat." Furthermore, if any habitat of a state-listed species on FTD is designated by Massachusetts as "significant habitat," the substantive requirements of the Massachusetts Endangered Species Act [Mass. Gen. L. ch. 131A (1991)], and its attendant regulations located at Mass. Regs. Code tit. 321, §§ 10.00-10.61 (1992), would be applicable.

2.6. Archaeological resources and historic sites

Prior to the development of Sudbury Annex and the surrounding towns, the principle land use in the area was agriculture (EEI 1993; Aneptek 1991). In 1984 a survey of cultural resources over approximately 20% of the installation was completed pursuant to the installation's responsibilities for these resources under federal legislation (EEI 1993). The survey identified twenty-eight (28) historic sites, two of which, the remains of Rice or Vose Tavern and the Puffer family homestead, were deemed potentially significant (EEI 1993). The survey also identified twenty-five prehistoric sites (EEI 1993). Three of these are apparently considered potentially significant, but further information regarding their descriptions and locations, etc. is not available at this time (EEI 1993). In addition, the Taylor Testing Area (Taylor Drop Zone) is the only facility in the United States that performs certain specific testing procedures involving materials dropped from remote control, drone airplanes (Aneptek 1991).

If any archaeological or historic resources are impacted by remedial activities, applicable requirements would develop under the Archaeological Resources Recovery Act of 1979 [16 U.S.C. §§ 470(aa)-470(ll) (1992)], 43 C.F.R. § 7 (1992), 32 C.F.R. § 229 (1992), the Archaeological and Historic Preservation Act [16 U.S.C. §§ 469(a)-469(c) (1992)], 40 C.F.R. § 6.301 (1992), and 32 C.F.R. § 650.181 (1992). In addition, any property that is eligible for the National Register of Historic Places or the National Historic Landmark Program, would be subject to applicable requirements under the National Historic Preservation Act [16 U.S.C. §§ 470(a)-470(w) (1992)], Executive Order 11593, 40 C.F.R. § 6.301 (1992), 36 C.F.R. § 800 (1992), and 32 C.F.R. § 650.181 (1992).

Massachusetts addresses the protection of historical and archaeological resources in the Antiquities Act located at Mass. Gen. L. ch. 9, § 26 (1992). The statute specifically authorizes the administration of the National Historic Preservation Act [16 U.S.C. §§ 470(a)-470(w) (1992)] within the Commonwealth at Mass. Gen. L. ch. 9, § 27B (1992).. The state register of historic places includes, among others, all properties listed on or eligible for the National Register of

Historic Places. Under regulations located at Mass. Regs. Code tit. 950, §§ 71.01-71.12 (1989) the Massachusetts Historical Commission (MHC) reviews any projects affecting the resources on the state list to determine if there will be adverse impacts on the resources and, if so, how to eliminate or mitigate those impacts. However, the MHC does not have veto power over projects as such and the regulations are not strictly "applicable" to CERCLA cleanup sites. However, relevant and appropriate requirements for remedial actions that impact state-listed resources can be found at Mass. Regs. Code tit. 950, § 71.05 (1989), which is promulgated pursuant to Mass. Gen. L. ch. 9, §§ 26-27C (1992).

Although not required, the process of consultation with the MHC to eliminate or mitigate adverse impacts may be recommended if any remedial alternatives at Sudbury Annex impact historical or archaeological resources. This is particularly true in light of the federal mandate to protect and preserve historical and archaeological resources and data and the fact that the federal review can be accomplished in conjunction with review by the MHC. Indeed, Mass. Regs. Code tit. 950, § 71.04(2) (1989) contemplates such coordination by providing that the review required under section 106 of the National Historic Preservation Act be undertaken, pursuant to Mass. Gen. L. ch. 9, § 27B (1992), by submission of the notification to the MHC.

2.7. Miscellaneous requirements

The Commonwealth regulations addressing TSD facility and solid waste landfill siting requirements have been discussed in Sections 2.3, 2.4, and 2.5 concerning impacts to floodplains, wetlands, wildlife resources, and endangered, threatened, or rare species. In addition, it is important to note that these regulations, located at Mass. Regs. Code tit. 310, §§ 30.700-30.707 (1989) and Mass. Regs. Code tit. 310, § 16.40(3) - (4) (1990), also address location requirements that involve resources not previously included in this document. These regulations require that the location of any new facility be evaluated with regard to transportation risks associated with the waste(s), adequacy of the buffer zone between active portions of the facility and areas of public access, population density in the vicinity of the site, proximity to "sensitive receptors" (eg. schools, hospitals, day care centers, residential dwellings, etc.), and proposed methods of evacuation of any populations that might be threatened in the event of any accident. In addition, buffer zones are required between the active portions of various facilities and their facility property lines and active farmland. These regulations may be relevant and appropriate requirements should the items or resources, etc. subject to the regulation be impacted by remedial actions. Given the location of Sudbury Annex within several towns and communities, particular attention should be paid to these requirements and their potential applicability.

REFERENCES

Aneptek. Aneptek Corporation. 1991. Endangered Species Survey - Phase I An Environmental Inventory of Wildlife Species and Their Habitats, Final Report. Contract No. DAAK6091P2517. Aneptek Corporation, Natick, MA.

EEI. Ecology and Environment, Inc. 1993. Master Environmental Plan - Fort Devens Sudbury Training Annex, Massachusetts. Contract No. DAAA15-90-D-0012. Ecology and Environment, Inc., Arlington, VA.

Foster, D. 1994. State Geologist, Executive Office of Environmental Affairs, Boston, MA. Personal communication, February 7, 1994 (617-727-9800).

Oldale, R. 1993. Geologist, Geologic Division, Woods Hole, MA. Personal communication, June 4, 1993.

Sinnott, J. 1992. State Geologist, Executive Office of Environmental Affairs, Boston, MA. Personal communication, April 16, 1992 (617-727-9800, ext. 213).

USEPA. United States Environmental Protection Agency. 1988. CERCLA Compliance With Other Laws, Draft Guidance. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

USEPA. United State Environmental Protection Agency. 1989. CERLCA Compliance With Other Laws Manual: Part II. Clean Air Act and Other Environmental Statutes and State Requirements. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

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ASSESSMENT OF CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) FOR FORT DEVENS SUDBURY TRAINING ANNEX, MASSACHUSETTS

REGULATORY DRAFT

February 23, 1994

CHEMICAL HAZARD EVALUATION GROUP
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INFORMATION ANALYSIS SECTION
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ASSESSMENT OF CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) FOR FT. DEVENS SUDBURY TRAINING ANNEX, MASSACHUSETTS

REGULATORY DRAFT

February 23, 1994

Chemical Hazard Evaluation Group
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ASSESSMENT OF CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) FOR THE FORT DEVENS SUDBURY TRAINING ANNEX, MASSACHUSETTS

1. INTRODUCTION

The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) was passed by Congress and signed into law on December 11, 1980 (Public Law 96-510). This act was intended to provide for "liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive waste disposal sites." The Superfund Amendments and Reauthorization Act (SARA), adopted on October 17, 1986 (Public Law 99-499), did not substantially alter the original structure of CERCLA but provided extensive amendments to it.

In particular, Title I, § 121 of SARA specifies that for any hazardous substance, pollutant, or contaminant that remains on-site, the level or standard of control that must be met shall be at least that of any legally applicable or relevant and appropriate regulation (ARAR), standard, criteria, or limitation under any federal environmental law or any more stringent standard promulgated under state environmental or facility siting law. Inherent in the interpretation of ARARs is the assumption that protection of human health and the environment is ensured.

The U.S. Army Environmental Center (USAEC) has asked the support of the Chemical Hazard Evaluation Group in the Health and Safety Research Division at Oak Ridge National Laboratory (ORNL) for assistance in determining chemical-specific ARARs for the Fort Devens Sudbury Training Annex (the Annex), Middlesex County, Massachusetts. The Annex was proposed for listing on the National Priorities List (NPL) in 1989 (54 FR 29820, July 14, 1989) and finalized in 1990 (55 FR 6154, February 21, 1990). The support document used in the preparation of this document is the Draft Master Environmental Plan (EEI 1993).

The following is a listing of the definitions of terms used throughout this report:

Applicable requirements are "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site" [40 CFR § 300.5 (1991)].

Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" [40 CFR § 300.5 (1991)].

Requirements under federal or state law may be *either* applicable *or* relevant and appropriate to CERCLA cleanup actions, but not both. However, requirements must be *both* relevant *and* appropriate for compliance to be necessary. In the case where a federal and a state ARAR are available, or where there are two potential ARARs addressing the same issue, the more stringent regulation must be selected. However, CERCLA §121(d)(4) provides several ARAR waiver options that may be invoked, providing that the basic premise of protection of human health and the environment is not ignored. A waiver is available for state standards that have not been applied uniformly in similar circumstances across the state.

CERCLA on-site remedial response actions must only comply with the substantive requirements of a regulation and not the administrative requirements to obtain federal, state, or local permits [CERCLA §121(e) and FFA §XXII]. To ensure that CERCLA response actions proceed as rapidly as possible, EPA has reaffirmed this position in the final NCP (55 Fed. Reg. 8756, March 8, 1990). **Substantive requirements** pertain directly to the actions or conditions at a site, while **administrative requirements** facilitate their implementation. EPA recognizes that certain of the administrative requirements such as consultation with state agencies, reporting, etc., are accomplished through the state involvement and public participation requirements of the NCP. These administrative requirements should be observed if they are useful in determining cleanup standards at the site.

In the absence of federal- or state-promulgated regulations, there are many criteria, advisories, guidance values, and proposed standards that are not legally binding but may serve as useful guidance for setting protective cleanup levels. These are not potential ARARs but are **"to-be-considered" (TBC)** guidance [40 CFR 300.400(g)(3)(1991)].

Selection of ARARs is dependent on the hazardous substances present at the site, the site characteristics and location, and the actions selected for a remedy. Thus, these requirements may be chemical-, location-, or action-specific. Chemical-specific ARARs are health- or risk-based concentration limits set for specific hazardous substances, pollutants, or contaminants. Location-specific ARARs address such circumstances as the presence of an endangered species on the site or the location of the site in a 100-year floodplain. Location-specific ARARs are being provided under separate cover. Action-specific ARARs control or restrict particular types of remedial actions selected as alternatives for cleanup of the site. Action-specific ARARs will be determined when remedial alternatives are selected during the Feasibility Study.

The Annex encompasses 2,750 acres and is located in Middlesex County, Massachusetts, 20 miles west of Boston. Portions of the towns of Maynard, Hudson, Marlboro, Stow, and Sudbury are within the boundaries of the installation. The Annex has served several uses including ammunition storage; ordnance research and development; laboratory research; equipment field testing; railroad operations; troop training; and disposal of cloth, food, and chemicals. Potential contaminants are explosives; solvents; pesticides and herbicides; polychlorinated biphenyls (PCBs); heavy metals; and petroleum fuels, oils and lubricants (EEI 1993). Past site assessments and remedial investigations identified 68 sites as potential areas of contamination. Feasibility studies are currently being conducted by OHM Corporation on three of the sites (A4, A7/P8, A9/P12). Twenty-eight of the sites are being

proposed for no further action. Site investigations/remedial investigations (SI/RI) are being conducted by Ecology and Environment, Inc. (E&E) on two of the sites (P11 and P37) and SIs are being conducted for 36 sites. This report will provide chemical-specific ARARs for all chemicals detected at the E&E sites. The sites have been grouped according to watersheds: Watershed 1A - Taylor Brook above Honey Brook; Watershed 1B - Taylor Brook below Honey Brook; Watershed 2 - Hop Brook Drainage; Watershed 3 - Unnamed tributary 1 to Assabet River (North End); Watershed 4 - unnamed tributary 2 to Assabet River (Northwest End); Watershed 5 - Boons Pond Drainage; and Watershed 6 - Run Brook (Willis Pond) Drainage.

The Annex is located near the western boundary of the Seaboard Lowland Section of the New England-Maritime physiographic province. The installation is located within the Eastern White Pine and Scarlet Oak forest cover types. Lowland areas, including bogs, marshes, and swamps, occur throughout the installation. The depth to the water table is less than 15 feet, with groundwater occurring mostly in the outwash plain underlying the lowlands. Groundwater flow in the glacial aquifers is controlled by surface geology and discharge to surface water bodies. Groundwater yields in the impermeable till or bedrock is low. On-site surface waters flow into the Assabet River, which is in the Concord River Basin. Most of the northern section of the Annex drains northward towards Taylor Brook and its associated tributaries, which eventually drain into the Assabet River. Honey Brook, which drains into Taylor Brook, originates in the western section of the installation. The southwestern and western sections of the Annex drain into either White Pond or Lake Boon, which discharge to the Assabet River. White Pond, which is used as a source of water supply for the town of Maynard, drains underground into Lake Boon. The remainder of the Annex drains into Hop Brook or it tributaries (Run Brook and Marlboro Brook). Hop Brook discharges to the Sudbury River prior to its confluence with the Assabet River (EEI 1993).

2. CHEMICAL-SPECIFIC ARARs

This report provides available chemical-specific ARARs or "to be considered" (TBC) guidance values to set protective cleanup levels for all chemicals detected in the designated media at the E&E sites or else indicate a safe level of discharge that may be incorporated when considering a specific remedial activity.

2.1. Federal and State ARARs

2.1.1. Drinking Water and Groundwater

In the final National Contingency Plan (NCP), EPA states a preference for Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs) and non-zero maximum contaminant level goals (MCLGs) or other health-based standards, criteria, or guidance for cleanup of Class I and II groundwater at CERCLA sites (55 FR 8732). The goal of EPA's approach to clean up contaminated groundwater is to return usable groundwater to its beneficial use within a given time frame that is reasonable given the particular circumstances at a CERCLA site. Although not an ARAR unless promulgated, the EPA guidance on

groundwater classification should be used to help in determining whether groundwater at a site falls within Class I, II or III. Classes I and IIA represent current sources of drinking water of varying value; Class IIB represents potential sources of drinking water; and Class III groundwater is not considered to be a potential source of drinking water and is of limited beneficial use. Restoration time periods vary depending on the use classification of the groundwater and may range from one year to several decades. Aquifers in certain areas of the Annex are used for drinking water supplies and certain areas of groundwater are classified by the Massachusetts Division of Water Supply as Zone II, which is a defined area of groundwater that contributes water to pumped wells with an approved capacity of >100,000 gallons/day (Blain 1994). Three public water supply wells in the Sudbury Water District (Wells #3, 8, and 10) are located within the Annex boundaries just north of Willis Pond. A public water supply well for the Maynard Public Works Department - Water Division (Well #3) is located within the Annex boundaries north of Puffer Pond. White Pond, located just south of the Annex boundary, serves as a public water supply for the town of Hudson. In addition, the Massachusetts Bureau of Waste Site Cleanup's Priority Resource Map for this area indicates areas of medium to high yield aquifers, particularly on the western side of the installation (Blain 1994). Consequently, certain areas of groundwater underlying the Annex would be classified by EPA's approach as Class I and IIA and certain areas of groundwater could be considered potential sources of drinking water or Class IIB. There is also the potential that other areas of groundwater may be unsuitable for water supply but may discharge to surface water bodies.

Although limited in number, chemical-specific standards pertaining to water quality have been established under the SDWA in 40 CFR 141 as National Primary Drinking Water Standards (NPDWS). These regulations are applicable to public water systems that have at least 15 service connections or serve an average of at least 25 people daily at least 60 days of the year. NPDWS include MCLs and MCLGs. The MCLs are enforceable standards that take into consideration human health effects, available treatment technologies, and costs of treatment. MCLs would be legally applicable to remediation of any Zone II groundwater or of groundwater that serves a public water supply well at the Annex. These MCLs would also be relevant and appropriate requirements for remediation of medium to high yield areas of groundwater that could be a potential source of drinking water supply. MCLGs are strictly health-based standards that disregard cost or treatment feasibility and are not legally enforceable, but would be relevant and appropriate for cleanup of groundwater at the Annex. Table 1 lists SDWA MCLs and MCLGs for the detected chemicals in groundwater at the Annex. Pursuant to the SDWA amendments of 1986, EPA has promulgated MCLs for fluoride (51 FR 11396, April 2, 1986, effective October 2, 1987); for benzene, 1,1-dichloroethylene, 1,1,1-trichloroethane, and trichloroethylene (52 FR 25690, July 8, 1987, effective January 9, 1989); for cadmium, chlordane, chlorobenzene, chromium, ethylbenzene, heptachlor, heptachlor epoxide, lindane, mercury, nitrate, polychlorinated biphenyls, selenium, tetrachloroethylene, toluene, and xylene (56 FR 3526, January 30, 1991, effective July 30, 1992); for barium (56 FR 30266, July 1, 1991, effective January 1, 1993); and for antimony, beryllium, endrin, methylene chloride, nickel, (57 FR 31776, July 17,1992, effective August 17, 1992).

The Commonwealth of Massachusetts has adopted Drinking Water Standards and Guidelines, expressed in terms of maximum levels of contaminants allowable in drinking

Table 1. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Groundwater Used as Drinking Water Supply at the E&E Sites at Sudbury Training Annex[a]

Chemical	Applicable			Relevant and Appropriate			TBC Guidance[b]			
	SDWA[c] MCL[d]	MMCL[e]	MA Groundwater Standard[f]	SDWA MCLGs[g]	MA SMCLs[h]	SDWA Action Level[i]	SDWA SMCL[j]	Drinking Water HA[k]	SDWA NIPDWR/ Proposed MCL[l]	MA ORSG[m]
Acetone			3,000							3,000
Alcohols (high molecular weight)										
Aluminum					50/200		50/200			
2-Amino-4,6-dinitrotoluene										
4-Amino-2,6-dinitrotoluene										
Antimony	6		6	6				3		6
Arsenic		50	50					0.02[n]	50	
Barium	2,000	2,000		2,000				2,000		
Benzene	5	5	5	0				1[n]		
Beryllium	4		4	0				0.008[n]		4
α-BHC										
Bicyclohexyl										
2-Butanone										
Cadmium	5	5	5	5				5		
Calcium										
Carbon disulfide										
α-Chlordane	2	5	5	0				0.03[n]		
Chlorobenzene	100	100	100					100		
Chlorodifluoromethane										
Chloroform		100[o]	5					6[n]	100[o]	5

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	SDWA[c] MCL[d]	MMCL[e]	MA Groundwater Standard[f]	SDWA MCLGs[g]	MA SMCLs[h]	SDWA Action Level[i]	SDWA SMCL[j]	Drinking Water HA[k]	SDWA NIPDWR/ Proposed MCL[l]	MA ORSG[m]
Chloromethane								3		
Chromium (IV)			50							
Chromium (Total)	100	100	100	100				100		
Cobalt										
Copper		1,300		1,300	1,000	1,300	1,000			
Cyclohexanol										
Cyclonite/hexahydro-1,3,5-trinitro-1,3,5-triazine/RDX								2		
Dacthal/DCPA								4,000		
p,p-DDD			0.1							
p,p-DDT			0.3							
1,3-Dichlorobenzene			600					600		
1,1-Dichloroethylene	7	7	7	7				7		
Dieldrin			0.1					0.002[n]		
N,N-Diethyl-3-methylbenzamide										
Dimethoxy dimethylsilane										
1,3-Dimethylbenzene/m-xylene										
1,4-Dimethylbenzene										
2,4-Dinitrotoluene			30							
Dioctyl adipate										
Endosulfan, B			0.4							

Table 1. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Groundwater Used as Drinking Water Supply at the E&E Sites at Sudbury Training Annex[a]

Chemical	Applicable			Relevant and Appropriate			TBC Guidance[b]			
	SDWA[c] MCL[d]	MMCL[e]	MA Groundwater Standard[f]	SDWA MCLGs[g]	MA SMCLs[h]	SDWA Action Level[i]	SDWA SMCL[j]	Drinking Water HA[k]	SDWA NIPDWR/ Proposed MCL[l]	MA ORSG[m]
Endrin	<u>2</u>	2	2	2				2		
Endrin aldehyde										
Ethylbenzene	<u>700</u>	700	700	700				700		
Ethyl methyl benzene										
1-Ethyl-2-methylbenzene										
Heptachlor	<u>0.4</u>	0.4	0.4	0				0.008[n]		
Heptachor epoxide	<u>0.2</u>	0.2	0.2	0				0.004[n]		
Hexamethylcyclotrisiloxane										
2-Hexanone										
Hydrocarbons (all molecular weights)										
4-Hydroxyl-4-methyl-2-pentanone										
Indan/Hydrindene										
Iron					<u>300</u>		300			
Lead		<u>15</u>	15	0		15				
Lindane	<u>0.2</u>	0.2	0.2	0.2				0.2		
Magnesium										
Manganese					<u>50</u>					
Mercury	<u>2</u>	2	2	2				2		
2-Methoxy-1-propene										
Methylene chloride	<u>5</u>		5	0						

Table 1. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Groundwater Used as Drinking Water Supply at the E&E Sites at Sudbury Training Annex[a]

Chemical	Applicable			Relevant and Appropriate			TBC Guidance[b]			
	SDWA[c] MCL[d]	MMCL[e]	MA Groundwater Standard[f]	SDWA MCLGs[g]	MA SMCLs[h]	SDWA Action Level[i]	SDWA SMCL[j]	Drinking Water HA[k]	SDWA NIPDWR/ Proposed MCL[l]	MA ORSG[m]
1-Methylindan										
Methylisobutyl ketone			350							350
1-Methylnaphthalene										
2-Methylnaphthalene			10							
Naphthalene			20					20		
Nickel	100		100	100				100		100
Nitrate	10,000	10,000		10,000						
Nitrobenzene										
Nitroglycerine										
2-Nitrotoluene										
3-Nitrotoluene										
4-Nitrotoluene										
Oil and grease										
PCB-1254	0.5	0.5	0.5	0				0.005[n]		
Pentaerythritol tetranitrate/PETN										
Phosphate										
Potassium										
Selenium	50	50	50	50						
Silver			40		100		100	100		
Sodium								20,000[k]		28,000

Table 1. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Groundwater Used as Drinking Water Supply at the E&E Sites at Sudbury Training Annex[a]

Chemical	Applicable			Relevant and Appropriate			TBC Guidance[b]			
	SDWA[c] MCL[d]	MMCL[e]	MA Groundwater Standard[f]	SDWA MCLGs[g]	MA SMCLs[h]	SDWA Action Level[i]	SDWA SMCL[j]	Drinking Water HA[k]	SDWA NIPDWR/ Proposed MCL[l]	MA ORSG[m]
Sulfate					<u>250,000</u>		250,000		400,000/ 500,000	
Sulfur										
Supraene/spinacene/squalene										
Tetrachloroethylene/ tetrachloroethene	<u>5</u>	5	5	0				0.7[n]		
Tetrahydrofuran										<u>1,300</u>
1,2,3,4-Tetramethylbenzene										
Toluene	<u>1,000</u>	1,000	1,000	1,000				1,000		
Total petroleum hydrocarbons			<u>1,000</u>							
1,1,1-Trichloroethane	<u>200</u>	200	200	200				200		
Trichloroethylene/Trichloroethene	<u>5</u>[q]	5	5	0				3[n]		
1,2,3-Trimethylbenzene										
Trimethylbenzenes										
1,3,5-Trinitrobenzene										
2,4,6-Trinitrotoluene								<u>2</u>		
Vanadium										
Xylene	<u>10,000</u>	10,000	10,000	10,000				10,000		
Zinc			<u>2,000</u>		5,000		5,000	2,000		

[a] This table provides ARARs or TBC guidance for all chemical historically detected in groundwater at Sudbury Training Annex (based on monitoring data from USAEC Installation Restoration Database Management Information System, as of December 21, 1993). The underlined values indicate the ARAR or TBC for each chemical. The

applicable requirements (SDWA MCLs and MMCLs) would also be relevant and appropriate requirements for remediation of the medium to high yield areas of groundwater underlying the Annex.

[b] TBC = "To be considered" guidance.

[c] SDWA = Safe Drinking Water Act.

[d] MCL = Maximum Contaminant Level. 52 FR 25690 (July 8, 1987); 56 FR 3526 (January 30, 1991); 56 FR 30266 (July 1, 1991); 57 FR 31776 (July 17, 1992).

[e] Code of Massachusetts Regulations, Title 310, Section 22, Drinking Water Regulations, effective November 20, 1992.

[f] Code of Massachusetts Regulations, Title 310, Section 40.0974(2), Groundwater Standards for category GW-1 July 30, 1993, effective October 1, 1993.

[g] MCLG = Maximum Contaminant Level Goal.

[h] SMCL = Secondary Maximum Contaminant Level, Code of Massachusetts Regulations, Title 310, Section 22, effective November 20, 1992.

[i] Established as an action level/MCLG, 56 FR 26460 (June 7, 1991), effective December 7, 1992.

[j] National Secondary Drinking Water Standards designed to protect the aesthetic quality of water (44 FR 42198, July 19, 1979; 51 FR 11396, April 2, 1986; 56 FR 3526, January 30, 1991).

[k] USEPA.Office of Water Lifetime Health Advisories (HA), May 1993. The value for sodium is a Drinking Water Equivalent Level guidance value.

[l] NIPDWR = National Interim Primary Drinking Water Regulation. NIPDWR for arsenic - 40 FR 59570 (December 24, 1975), Notice of Proposed Rulemaking expected September 1994, Final rule expected September 1996. Proposed MCL for sulfates - 55 FR 303070, September 25, 1990, EPA has deferred setting final standard pending further study (57 FR 31776, July 17, 1992).

[m] ORSG = Office of Research and Standard Guidelines, Massachusetts Department of Environmental Protection, Spring 1993. The ORSG for chloroform is for non-chlorinated water supplies.

[n] USEPA Office of Water Health Advisory representing a 10^{-6} cancer risk, the concentration in drinking water that will result in one excess cancer death in one million people.

[o] These values are for Total Trihalomethanes, which is the sum of the concentration of chloroform, bromodichloromethane, dibromochloromethane, and bromoform. NIPDWR 40 FR 59570 (December 24, 1975), effective June 24, 1976.groundwater classification should be used to help in determining whether groundwater at a site falls within Class I, II or III. Classes I and IIA represent current sources of drinking water of varying value; Class IIB represents potential sources of drinking water; and Class III groundwater is not considered to be a potential source of drinking water and is of limited beneficial use. Restoration time periods vary depending on the use classification of the groundwater and may range from one year to several decades. Aquifers in certain areas of the Annex are used for drinking water supplies and certain areas of groundwater are classified by the Massachusetts Division of Water Supply as Zone II, which is a defined area of groundwater that contributes water to pumped wells with an approved capacity of > 100,000 gallons/day (Blain 1994). Three public water supply wells in the Sudbury Water District (Wells #3, 8, and 10) are located within the Annex boundaries just north of Willis Pond. A public water supply well for the Maynard Public Works Department - Water Division (Well #3) is located within the Annex boundaries north of Puffer Pond. White Pond, located just south of the Annex boundary, serves as a public water supply for the town of Hudson. In addition, the Massachusetts Bureau of Waste Site Cleanup's Priority Resource Map for this area indicates areas of medium to high yield aquifers, particularly on the western side of the installation (Blain 1994). Consequently, certain areas of groundwater underlying the Annex would be classified by EPA's approach as Class I and IIA and certain areas of groundwater could be considered potential sources of drinking water or Class IIB. There is also the potential that other areas of groundwater may be unsuitable for water supply but may discharge to surface water bodies.

Although limited in number, chemical-specific standards pertaining to water quality have been established under the SDWA in 40 CFR 141 as National Primary Drinking Water Standards (NPDWS). These regulations are applicable to public water systems that have at least 15 service connections or serve an average of at least 25 people daily at least 60 days of the year. NPDWS include MCLs and MCLGs. The MCLs are enforceable standards that take into consideration human health effects, available treatment technologies, and costs of treatment. MCLs would be legally applicable to remediation of any Zone II groundwater or of groundwater that serves a public water supply well at the Annex. These MCLs would also be relevant and appropriate requirements for remediation of medium to high yield areas of groundwater that could be a potential source of drinking water supply. MCLGs are strictly health-based standards that disregard cost or treatment feasibility and are not legally enforceable, but would be relevant and appropriate for cleanup of groundwater at the Annex. Table 1 lists SDWA MCLs and MCLGs for the detected chemicals in groundwater at the Annex. Pursuant to the SDWA amendments of 1986, EPA has promulgated MCLs for fluoride (51 FR 11396, April 2, 1986, effective October 2, 1987); for benzene, 1,1-dichloroethylene, 1,1,1-trichloroethane, and trichloroethylene (52 FR 25690, July 8, 1987, effective January 9, 1989); for cadmium, chlordane, chlorobenzene, chromium, ethylbenzene, heptachlor, heptachlor epoxide, lindane, mercury, nitrate, polychlorinated biphenyls, selenium, tetrachloroethylene, toluene, and xylene (56 FR 3526, January 30, 1991, effective July 30, 1992); for barium (56 FR 30266, July 1, 1991, effective January 1, 1993); and for antimony, beryllium, endrin, methylene chloride, nickel, (57 FR 31776, July 17,1992, effective August 17, 1992).

water. The Commonwealth lists its Maximum Contaminant Levels (MMCLs) in Section 22. Drinking Water Regulations, Code of Massachusetts Regulations, Title 310 (310 CMR 22.05 to 22.09), effective November 20, 1992. The Division of Water Supply is the enforcement authority. The MMCLs are also listed in Table 1 as applicable requirements for cleanup of Zone II groundwater and of groundwater that serves a public water supply well at the Annex. As with the SDWA MCLs, the MMCLs would also be relevant and appropriate requirements for remediation of the medium to high yield groundwater that could be a potential source of drinking water supply. The MMCLs are identical to the SDWA MCLs, with the exception of chlordane for which the SDWA MCL of 2 $\mu g/L$ is stricter than the MMCL of 5 $\mu g/L$; consequently the SDWA MCL would be the applicable requirement (see Table 1).

The Commonwealth of Massachusetts has also established Groundwater Standards in the Massachusetts Contingency Plan (310 CMR 40, July 30, 1993, effective October 1, 1993), promulgated pursuant to Massachusetts General Law c. 21E. These standards apply to the cleanup of disposal sites and are developed using a Method 1 risk characterization approach (310 CMR 40.0970), which compares the current and reasonably foreseeable use of the groundwater at the disposal site to promulgated standards (MMCLs in 310 CMR 22; Groundwater Quality Standards in 314 CMR 6). The groundwater category (GW-1, GW-2, GW-3) identified for the site determines which standards apply. Category GW-1 groundwater is defined as groundwater within a Zone II; within a Wellhead Protection Area; within a potentially productive area; within Zone A of a Class A surface water body; within 500 feet or more of a public water system distribution pipeline; or within 500 feet of a private water supply well that is in compliance with pertinent regulations. Based on these definitions in 310 CMR 40.0932, certain areas of groundwater at the Annex would be in Category GW-1 established by the Department of Environmental Protections's Division of Water Supply, pursuant to 310 CMR 22.02. Consequently, the MCP Method 1 Groundwater Standards provided in the GW-1 column of 310 CMR 40.0974(2) and in Table 1 of this document will be considered applicable requirements for cleanup of these areas of contaminated groundwater at the Annex. GW-3 Groundwater Standards would be applicable requirements for the remediation of groundwater underlying the Annex that potentially discharges to surface waters and that is not a current or potential source of drinking water. These standards are presented in Table 2 for all of the detected chemicals in groundwater at the Annex. The GW-1 Groundwater Standards are identical to the SDWA MCLs and/or MMCLs for several of the chemicals detected at the Annex (see Table 1). The Commonwealth of Massachusetts has also established MCP Method 1 Groundwater Standards for chemicals for which a SDWA MCL or MMCL has not been promulgated, including acetone, chloroform, chromium VI, DDD, DDT, 1,3-dichlorobenzene, dieldrin, 2,4-dinitrotoluene, endosulfan B, methyl isobutyl ketone, 2-methylnaphthalene, naphthalene, silver, total petroleum hydrocarbons, and zinc. These standards would be ARAR for cleanup of these chemicals in groundwater used as drinking water at the site (see Table 1). According to 310 CMR 40.0983, if an MCP Method 1 Groundwater Standard has not been promulgated by the Department, a Licensed Site Professional may develop an MCP Method 2 Standard for the chemical, based on either background concentrations, non-cancer or cancer risk, or the Practical Quantitation Limit. The non-cancer health risk would be a

Table 2. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of GW-3 Groundwater at the E&E Sites at the Sudbury Training Annex	
Chemical	MA Groundwater Standard GW-3[a]
Acetone	50,000
Alcohols (high molecular weight)	
Aluminum	
2-Amino-4,6-dinitrotoluene	
4-Amino-2,6-dinitrotoluene	
Antimony	300
Arsenic	400
Barium	
Benzene	7,000
Beryllium	50
α-BHC	
Bicyclohexyl	
2-Butanone	
Cadmium	10
Calcium	
Carbon disulfide	
α-Chlordane	2
Chlorobenzene	500
Chlorodifluoromethane	
Chloroform	10,000
Chloromethane	
Chromium (IV)	100
Chromium (Total)	2,000
Cobalt	
Copper	
Cyclohexanol	
Cyclonite/hexahydro-1,3,5-trinitro-1,3-5-triazine/RDX	
Dacthal/DCPA	
p,p-DDD	6

Table 2. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of GW-3 Groundwater at the E&E Sites at the Sudbury Training Annex

Chemical	MA Groundwater Standard GW-3[a]
p,p-DDT	0.3
1,3-Dichlorobenzene	8,000
1,1-Dichloroethene	50,000
Dieldrin	0.1
N,N-Diethyl-3-methylbenzamide	
Dimethoxy dimethylsilane	
1,3-Dimethylbenzene/m-xylene	
1,4-Dimethylbenzene	
2,4-Dinitrotoluene	2,000
Dioctyl adipate	
Endosulfan, B	0.1
Endrin	5
Endrin aldehyde	
Ethylbenzene	4,000
Ethyl methyl benzene	
1-Ethyl-2-methylbenzene	
Heptachlor	1
Heptachor epoxide	2
Hexamethylcyclotrisiloxane	
2-Hexanone	
Hydrocarbons (all molecular weights)	
4-Hydroxyl-4-methyl-2-pentanone	
Indan/Hydrindene	
Iron	
Lead	30
Lindane	0.8
Magnesium	
Manganese	
Mercury	1
2-Methoxy-1-propene	

Table 2. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of GW-3 Groundwater at the E&E Sites at the Sudbury Training Annex	
Chemical	MA Groundwater Standard GW-3[a]
Methylene chloride	50,000
1-Methylindan	
Methyl isobutyl ketone	50,000
1-Methylnaphthalene	
2-Methylnaphthalene	3,000
Naphthalene	6,000
Nickel	80
Nitrate	
Nitrobenzene	
Nitroglycerine	
2-Nitrotoluene	
3-Nitrotoluene	
4-Nitrotoluene	
Oil and grease	
PCB-1254	0.3
Pentaerythritol tetranitrate/PETN	
Phosphate	
Potassium	
Selenium	80
Silver	7
Sodium	
Sulfate	
Sulfur	
Supraene/spinacene/squalene	
Tetrachloroethylene/tetrachloroethene	5,000
Tetrahydrofuran	
1,2,3,4-Tetramethylbenzene	
Toluene	50,000
Total petroleum hydrocarbons	50,000
1,1,1-Trichloroethane	50,000

Table 2. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of GW-3 Groundwater at the E&E Sites at the Sudbury Training Annex	
Chemical	MA Groundwater Standard GW-3[a]
Trichloroethylene/Trichloroethene	20,000
1,2,3-Trimethylbenzene	
Trimethylbenzenes	
1,3,5-Trinitrobenzene	
2,4,6-Trinitrotoluene	
Vanadium	
Xylene (total)	50,000
Zinc	900

[a] Code of Massachusetts Regulations. Title 310, Section 40.0974(2), Groundwater Standards for category GW-3 July 30, 1993, effective October 1, 1993.

concentration in drinking water of the chemical associated with 20% of an allowable daily dose. The cancer risk value would be the concentration of the chemical associated with an excess lifetime cancer risk of 10^{-6}.

The Commonwealth of Massachusetts has established MMCLs and Groundwater Standards of 15 μg/L and 50 μg/L for lead and arsenic, respectively, and an MMCL of 1,300 μg/L for copper. USEPA, under the SDWA, has promulgated action levels for lead and copper that are identical to the MMCLs and/or Groundwater Standard. The federal action levels are relevant and appropriate requirements for Superfund sites with contaminated groundwater. The MMCL for lead would be the applicable requirement for Zone II groundwater and for groundwater that serves a public water supply well. Massachusetts has also promulgated a stricter secondary MCL (SMCL) for copper of 1,000 μg/L that would be relevant and appropriate for groundwater cleanup at the site. Consequently, based on strictness, the SMCL would be the selected ARAR. Exceedance of the SDWA action levels indicates potential source water (groundwater) contamination and triggers the need to implement either optimal corrosion control for systems serving <50,000 people or source water monitoring and possible treatment, public education, and lead service line replacement for all systems. It is not equivalent to an MCL but is a treatment technique requirement. Upon exceedance, the water system is required to collect source water samples and submit the results to the Commonwealth of Massachusetts. Within six months of exceeding the action level, the water system is required to recommend in writing to the Commonwealth a proposed source water treatment. The Commonwealth of Massachusetts would then be required to analyze the monitoring results and treatment recommendation to determine the technology that would be most effective at reducing contaminant levels in water delivered to the user's tap. Follow-up source water and tap samples are to be taken within 12 months of the installation of the treatment and submitted to the Commonwealth. The Commonwealth will then establish maximum permissible lead levels in source water that the water system must maintain.

National Secondary Drinking Water Regulations have also been established under the SDWA in 40 CFR Part 143. The secondary standards are known as SMCLs, and are levels established to regulate the aesthetic qualities related to public acceptance of drinking water. The federal regulations are not enforceable but rather are intended to serve as guidelines for use by states. Therefore, they are not considered as potential ARARs but are listed in Table 1 as "to-be-considered" guidance. Massachusetts SMCLs that have been promulgated, pursuant to 310 CMR Section 22 (effective November 20, 1992) are legally enforceable and are relevant and appropriate for cleanup of groundwater at the Annex. The Massachusetts SMCLs for aluminum, iron, manganese, and sulfates would be relevant and appropriate requirements for cleanup of groundwater at the Annex (see Table 1).

2.1.2. Surface Water and Sediment

CERCLA §121(d)(2)(A) specifically states that remedial actions shall at least attain federal ambient water quality criteria (WQC) established under the Clean Water Act (CWA) if they are relevant and appropriate. In determining whether any WQC are relevant and appropriate, one must consider the "designated or potential use of the surface water, the environmental media affected, the purposes for which the criteria were developed, and the latest information available" [CERCLA §121(d)(2)(B)]. Federal WQC are derived for the protection of human

Table 3. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Surface Water at the E&E Sites at Sudbury Training Annex[a]

Chemical	Massachusetts/CWA WQC for Protection of Human Health[b]		Massachusetts/CWA WQC for Protection of Aquatic Organisms[c]	
	Consumption of Aquatic Organisms and Drinking Water[d]	Consumption of Aquatic Organisms Only[d]	Freshwater Acute[e]	Freshwater Chronic[f]
Acetone				
Aluminum				
Arsenic	0(0.018)	0(0.14)	360	190
Barium				
2-Butanone				
2-(2-N-Butoxyethoxy)ethanol				
Calcium				
Carbonic acid dimethyl ether				
Chromium				
Chromium (IV)			16	11
Copper			18[g]	12[g]
Dacthal/DCPA				
p,p-DDD	0(0.00059)	0(0.00059)		
p,p-DDE	0(0.00083)	0(0.00084)		
Dimethoxy dimethylsilane				
Dioctyl adipate				
2E1HXL				
Endosulfan sulfate	0.93	2.0		
Endrin	0.76	0.81	0.18	0.0023
Hexadecanoic acid/Palmitic acid				
Hexamethylcyclotrisiloxane				

Table 3. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Surface Water at the E&E Sites at Sudbury Training Annex[a]

Chemical	Massachusetts/CWA WQC for Protection of Human Health[b]		Massachusetts/CWA WQC for Protection of Aquatic Organisms[c]	
	Consumption of Aquatic Organisms and Drinking Water[d]	Consumption of Aquatic Organisms Only[d]	Freshwater Acute[e]	Freshwater Chronic[f]
Hydrocarbons (all molecular weights)				
4-Hydroxy-4-methyl-2-pentanone				
Iron				
Lead			82[g]	3.2[g]
Magnesium				
Manganese				
2-(2-Methoxyethoxy)ethanol				
Methylene chloride	0(4.7)	0(1600)		
3-Nitrotoluene				
Oil and grease[h]				
Phenol	21,000	4,600,000		
Phenoxyacetic acid				
2-Phenoxyethanol				
2-(2-N-Phenoxyethoxy)ethanol				
Phosphate				
Potassium				
Selenium			20	5
Silver			4.1[g]	
Sodium				
Sulfur				
1,1,2,2-Tetrachloroethane	0(0.17)	0(11)		

Table 3. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Surface Water at the E&E Sites at Sudbury Training Annex[a]

Chemical	Massachusetts/CWA WQC for Protection of Human Health[b]		Massachusetts/CWA WQC for Protection of Aquatic Organisms[c]	
	Consumption of Aquatic Organisms and Drinking Water[d]	Consumption of Aquatic Organisms Only[d]	Freshwater Acute[e]	Freshwater Chronic[f]
Tetracosane				
Toluene	6800	200,000		
1,1,2-Trichloroethane	0(0.60)	0(42)		
2,2,4-Trimethyl-1,3-pentanediol				
Vanadium				
Xylene				
Zinc			120[g]	110[g]

[a] This table provides ARARs for all chemicals historically detected in surface water at Group IB site, Fort Devens (based on monitoring data from USAEC Installation Restoration Database Management Information System, Inc. as of December 21, 1993). All values in this table are given in $\mu g/L$. The underlined values indicate the strictest ARAR for each chemical.

[b] WQC = Water Quality Criteria from Code of Massachusetts Regulation, Title 314, Section 4.05(5)(e)/U.S. Environmental Protection Agency, 57 FR 60848, December 22, 1992.

[c] WQC = Water Quality Criteria from Code of Massachusetts Regulation, Title 314, Section 4.05(5)(e)/U.S. Environmental Protection Agency, 57 FR 60848, December 22, 1992.

[d] The criterion value of zero for all potential carcinogens is listed in the table. Concentrations in parentheses for potential caricnogens correspond to a risk of 10^{-6}.

[e] One-hour average concentration not to be exceeded more than once every 3 years.

[f] Four-hour average concentration not to be exceeded more than once every 3 years.

[g] Water hardness dependent criteria (100 mg/L as $CaCO_3$).

[h] See Section 2.1.2. of the text for the Commonwealth narrative criterion.

health from the consumption of contaminated drinking water and/or aquatic organisms and for the protection of freshwater aquatic organisms. The Code of Massachusetts Regulations, Title 314, Chapter 4, Surface Water Quality Standards, effective February 28, 1992, classifies the surface waters of the Commonwealth according to the uses of those waters. Chapter 4 also prescribes the water quality criteria necessary to achieve those classifications and specifies other policies, including the prohibition of discharges to those waters where necessary. The Annex lies within the Concord River Basin which has a Class B Waterway classification. Taylor Brook, Honey Brook, Marlboro Brook, and other unnamed streams and tributaries flow through the Annex discharging either directly or indirectly into the Assabet or Concord Rivers. Both of these rivers are Class B waters. The northern portion of the Annex flows directly to the Assabet River via Taylor Brook and its tributaries. The southwestern and western sides of the Annex drain primarily into Lake Boon or White Pond, located outside the southwest boundary of the Annex, which, in turn, discharges into the Assabet River. White Pond is listed as a Class A water in Table 23 of Chapter 4 of the Code. None of the sites of concern for this document drain into White Pond. The detached south portion of the Annex drains into Hop Brook, which discharges into the Concord River. Puffer Pond, Willis Pond, Cutting Pond, and Vose Pond are located within the boundaries of the Annex (EEI 1993). Because none of these ponds are listed in Table 23 of Chapter 4 of the Code, they are automatically classified as Class B waters (Hogan 1992). Class B waters are designated as habitat for fish, other aquatic and wildlife, and for primary and secondary contact recreation. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value [314 CMR 4.05(3)(b)]. The state surface water minimum criteria for Class B waters are consistent with the federal WQC (Hogan 1992). The other state criteria are narrative except for those pollutants that have prescribed minimum water quality criteria established by EPA pursuant to Section 304(a) of the federal Clean Water Act [314 CMR 4.05(5)(e)], and except where a site-specific limit is established pursuant to 314 CMR 4.05(5)(e)(1-4). The Commonwealth narrative criterion for oil and grease states that Class B waters "shall be free from oil, grease and petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course, or are deleterious or become toxic to aquatic life" [314 CMR 4.05(3)(b)(5)].

Table 3 lists Massachusetts and federal CWA WQC for the protection of human health for the consumption of aquatic organisms and drinking water and for the consumption of aquatic organisms alone and Massachusetts and federal CWA WQC for the protection of aquatic organisms, acute and chronic for the chemicals detected in surface waters at the Annex. The Massachusetts WQC would be considered applicable for the remediation of contamination in the on-site surface water bodies of the Concord River Basin; the CWA WQC are relevant and appropriate requirements for remediation of these water bodies.

Massachusetts also includes antidegradation provisions for surface waters, codified at 314 CMR 4.04 (1990). The regulation requires the protection of existing uses and states that "In all cases existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected." The policy is an anti-pollution requirement rather than a cleanup requirement and would not be considered a chemical-specific ARAR. In addition, it would not the policy itself that would be ARAR but the standards that are promulgated to carry out the policy that would ARAR, the uses and associated criteria for specified water

bodies. Promulgation simply means that these standards have gone through rulemaking and public notice and comment.

There are no set maximum allowable residual levels for chemicals in sediments under federal or Massachusetts state law.

2.1.3. Soil

There are no set maximum allowable residual levels for chemicals in soils under federal law.

The Commonwealth of Massachusetts has established Soil Standards in the Massachusetts Contingency Plan (310 CMR 40, July 30, 1993, effective October 1, 1993), promulgated pursuant to Massachusetts General Law c. 21E. These standards apply to the cleanup of disposal sites and are developed using either a Method 1 (310 CMR 40.0975) or 2 (310 CMR 40.0985) risk characterization approach. MCP Method 1 involves the characterization of risk through the use of promulgated standards and considers the risk from direct exposure to the chemical in soil and the potential impacts on the groundwater through leaching. MCP Method 2 involves the application of site-specific methodologies and considers the risk from direct contact with the soil. The category of soil (S-1, S-2, S-3) at the exposure point determines the applicable Soil Standard. The soil categories are based on the potential for exposure, which involves the frequency of use, the intensity of use, and the accessibility for adults and/or children (310 CMR 40.0933). Table 4 provides the MCP Method 1 Soil Standards for GW-1 groundwater and all three soil categories and the MCP Method 2 Soil Standards for all three soil categories for the chemicals detected in soils at the E&E sites at the Annex. Table 5 provides the MCP Method 1 Soil Standards for GW-3 groundwater and all three soil categories and the MCP Method 2 Soil Standards for all three soil categories for these chemicals. 310 CMR 40.0933(9) provides a matrix to be used to identify the appropriate soil category for exposure potential. Based on the selected soil category, the values provided in Tables 4 or 5 would be considered applicable requirements for cleanup of contaminated soil at the Annex. According to 310 CMR 40.0984, if an MCP Method 1 Soil Standard has not been promulgated by the Department, a Potentially Responsible Party may develop an MCP Method 2 Standard for the chemical, based on several factors, including the background concentrations, non-cancer or cancer risk using the equations provided in the regulation, or the Practical Quantitation Limit. The non-cancer health risk would be a concentration in soil of the chemical associated with 20% of an allowable daily dose. The cancer risk value would be the concentration of the chemical associated with an excess lifetime cancer risk of 10^{-6}.

2.2. OTHER GUIDANCE TO BE CONSIDERED

2.2.1. Groundwater

Additional TBC guidance values are provided in Table 1 for any groundwater contaminant for which a final SDWA or Commonwealth MCL/MCLG, SMCL, or Groundwater Standard is yet to be promulgated. In the absence of federal- or state-promulgated ARARs, or in the case where ARARs are not adequately protective, EPA states a preference for Office of Drinking Water (ODW) Health Advisories (HAs), Reference Doses (RfDs) for systemic toxi

Table 4. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Soil (S-1, S-2, S-3, GW-1) at the E&E Sites at Sudbury Training Annex[a]

Chemical	MCP Method 1[b] S-1 Soil + GW-1	MCP Method 1[b] S-2 Soil + GW-1	MCP Method 1[b] S-3 Soil + GW-1	MCP Method 2[c]		
				S-1 Soil	S-2 Soil	S-3 Soil
Acenaphthene	20	20	20	1,000	2,500	5,000
Acetone	3	3	3	500	1,000	5,000
Alcohol (high molecular weight)						
Aldehydes						
Aluminum						
4-Amino-2,6-dinitrotoluene						
Anthracene	1,000	1,000	1,000	1,000	2,500	5,000
Antimony	10	40	40	10	40	40
Arsenic	30	30	30	30	30	30
Barium						
Benzo(a)anthracene	0.7	0.7	0.7	0.7	0.7	0.7
Benzo(a)pyrene	0.7	0.7	0.7	0.7	0.7	0.7
Benzo(b)fluoranthene	0.7	0.7	0.7	0.7	0.7	0.7
Benzo(b)fluorene						
Benzo(ghi)perylene	100	100	100	1,000	2,500	2,500
Benzo(e)pyrine						
Benzo(k)fluoranthene	0.7	0.7	0.7	0.7	0.7	0.7
Benzo(j)fluoranthene						
Beryllium	0.4	0.8	3	0.4	0.8	3
ß-BHC						
Δ-BHC						
2-Butanone						

Table 4. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Soil (S-1, S-2, S-3, GW-1) at the E&E Sites at Sudbury Training Annex[a]

Chemical	MCP Method 1[b] S-1 Soil + GW-1	MCP Method 1[b] S-2 Soil + GW-1	MCP Method 1[b] S-3 Soil + GW-1	MCP Method 2[c]		
				S-1 Soil	S-2 Soil	S-3 Soil
Cadmium	30	80	80	30	80	80
Calcium						
Camphor						
Carbazole						
Carbonic acid dimethyl ether						
α-Chlordane						
μ-Chlordane						
Chlorobenzene	8	8	8	500	1,000	2,500
Chloroform	0.1	0.1	0.1	100	200	500
Chromium	1,000	2,500	5,000	1,000	2,500	5,000
Chrysene	0.7	0.7	0.7	0.7	0.7	0.7
Cobalt						
Copper						
Cyclonite/hexahydro-1,3,5-trinitro-1,3-5-triazine/RDX						
Cyclotetramethylene-tetranitramine/HMX						
Dacthal/DCPA						
p,p-DDD	2	3	10	2	3	10
p,p-DDE	2	2	9	2	2	9
p,p-DDT	2	2	9	2	2	9
Dibenzofuran						
1,2-Dichloroethane	0.05	0.05	0.05	10	20	60

Table 4. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Soil (S-1, S-2, S-3, GW-1) at the E&E Sites at Sudbury Training Annex[a]

Chemical	MCP Method 1[b] S-1 Soil + GW-1	MCP Method 1[b] S-2 Soil + GW-1	MCP Method 1[b] S-3 Soil + GW-1	MCP Method 2[c]		
				S-1 Soil	S-2 Soil	S-3 Soil
Dieldrin	0.03	0.04	0.1	0.03	0.04	0.2
Diethyl phthalate	100	100	100	1,000	2,500	5,000
1,3-Dimethylcyclohexane						
1,4-Dimethylcyclohexane						
1,3-Dimethylbenzene/m-xylene						
1,5-Dimethylnaphthalene						
2,4-Dinitrotoluene						
2,6-Dinitrotoluene						
Dioctyl adipate						
Endosulfan, A and sulfate						
Endosulfan, B						
Endrin	0.6	0.6	0.6	6	10	10
Ethylbenzene	80	80	80	500	1,000	2,500
1-Ethyl-2-methylbenzene						
Fluoranthene	600	600	600	900	2,000	5,000
Fluorene	400	400	400	800	2,000	5,000
Heptachlor	0.1	0.2	0.7	0.1	0.2	0.7
Heptachlor epoxide	0.06	0.09	0.3	0.06	0.09	0.3
Heptacosane						
Heptadecane						
Hexachlorobiphenyls						
Hexadecane						

Table 4. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Soil (S-1, S-2, S-3, GW-1) at the E&E Sites at Sudbury Training Annex[a]

Chemical	MCP Method 1[b] S-1 Soil + GW-1	MCP Method 1[b] S-2 Soil + GW-1	MCP Method 1[b] S-3 Soil + GW-1	MCP Method 2[c]		
				S-1 Soil	S-2 Soil	S-3 Soil
Hexadecanoic acid/Palmitic acid						
Hexamethylcyclotrisiloxane						
2,2,4,4,7,7-Hexamethyloctahydro-1H-indene						
2-Hexanone						
Hexatriacontane						
Hydrocarbons (all molecular weights)						
Indeno(1,2,3-cd)pyrene						
Iron						
Isophorone						
Lead	300	600	600	300	600	600
Lindane	0.1	0.1	0.1	0.4	0.6	2
Linoleic acid						
Magnesium						
Manganese						
Mercury	10	60	60	10	60	60
Mesityl oxide						
Methylene chloride	0.1	0.1	0.1	100	200	700
4-Methyl-1-(1-methylethyl)-bicyclo[3,1,0]hex-2-ene						
2-Methylnaphthalene	0.7	0.7	0.7	1,000	2,500	2,500
3-Methylpentane						

Table 4. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Soil (S-1, S-2, S-3, GW-1) at the E&E Sites at Sudbury Training Annex[a]

Chemical	MCP Method 1[b] S-1 Soil + GW-1	MCP Method 1[b] S-2 Soil + GW-1	MCP Method 1[b] S-3 Soil + GW-1	MCP Method 2[c]		
				S-1 Soil	S-2 Soil	S-3 Soil
Naphthalene	4	4	4	100	2,500	2,500
Nickel	300	700	700	300	700	700
Nitroglycerine						
2-Nitrotoluene						
3-Nitrotoluene						
Nonane						
Octadecanoic acid/ stearic acid						
Octane						
Oil and grease						
PCB-1242	2	2	2	2	2	2
PCB-1248	2	2	2	2	2	2
PCB-1254	2	2	2	2	2	2
PCB-1260	2	2	2	2	2	2
2,2',4,4',5-Pentachloro-1,1'-biphenyl						
2,3',4,4',5-Pentachloro-1,1'-biphenyl						
Pentaerythritol tetranitrate/PETN						
Pentatriacontane						
Petroleum distillates						
Phenanthrene	700	700	700	1,000	2,500	2,500
Phenol	60	60	60	500	1,000	2,500
1-Phenylpropane/n-propylbenzene						

Table 4. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Soil (S-1, S-2, S-3, GW-1) at the E&E Sites at Sudbury Training Annex[a]

Chemical	MCP Method 1[b] S-1 Soil + GW-1	MCP Method 1[b] S-2 Soil + GW-1	MCP Method 1[b] S-3 Soil + GW-1	MCP Method 2[c]		
				S-1 Soil	S-2 Soil	S-3 Soil
Phosphate						
α-Pinene						
Potassium						
2-Propanol						
Pyrene	500	500	500	700	2,000	5,000
Selenium	300	2,500	2,500	300	2,500	2,500
Silver	100	200	200	100	200	200
Sodium						
Steroids						
Sulfur						
Tetrachloroethylene/ tetrachloroethene	1	1	1	200	300	1,000
1,2,3,4-Tetramethylbenzene						
2,6,10,14-Tetramethylpentadecane						
Thallium	8	30	100	8	30	100
Toluene	80	80	80	500	1,000	2,500
Total organic carbon						
Total petroleum hydrocarbons	500	2,500	5,000	500	2,500	5,000
Total phosphates						
2,4,5-TP/silvex						
1,1,1-Trichloroethane	10	10	10	100	500	500
1,1,2-Trichloroethane	0.3	0.3	0.3	2	3	10

Table 4. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Soil (S-1, S-2, S-3, GW-1) at the E&E Sites at Sudbury Training Annex[a]

Chemical	MCP Method 1[b] S-1 Soil + GW-1	MCP Method 1[b] S-2 Soil + GW-1	MCP Method 1[b] S-3 Soil + GW-1	MCP Method 2[c]		
				S-1 Soil	S-2 Soil	S-3 Soil
Trichloroethylene	0.5	0.5	0.5	70	100	500
Trichlorofluoromethane						
1,3,5-Trimethylbenzene						
1,7,7-Trimethylbicyclo[2,2,1] hept-2-ene						
1,1,3-Trimethylcyclohexane						
2,4,6-Trinitrotoluene						
Vanadium						
Xylenes, total	500	800	800	500	1,000	2,500
Zinc	2,500	2,500	5,000	2,500	2,500	5,000

[a] All values are in µg/g, Code of Massachusetts Regulations Title 310, Section 40.0975(6)(a-c); Section 40.0985(6), July 30, 1993; effective October 1, 1993.
[b] Direct contact exposure- and leachate-based soil concentrations.
[c] Direct contact exposure-based soil concentrations.

Table 5. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Soil (S-1, S-2, S-3, GW-3) at the E&E Sites at Sudbury Training Annex[a]

Chemical	MCP Method 1[b] S-1 Soil + GW-3	MCP Method 1[b] S-2 Soil + GW-3	MCP Method 1[b] S-3 Soil + GW-3	MCP Method 2[c]		
				S-1 Soil	S-2 Soil	S-3 Soil
Acenaphthene	1,000	2,000	2,000	1,000	2,500	5,000
Acetone	60	60	60	500	1,000	5,000
Alcohol (high molecular weight)						
Aldehydes						
Aluminum						
4-Amino-2,6-dinitrotoluene						
Anthracene	1,000	1,000	1,000	1,000	2,500	5,000
Antimony	10	40	40	10	40	40
Arsenic	30	30	30	30	30	30
Barium						
Benzo(a)anthracene	0.7	0.7	0.7	0.7	0.7	0.7
Benzo(a)pyrene	0.7	0.7	0.7	0.7	0.7	0.7
Benzo(b)fluoranthene	0.7	0.7	0.7	0.7	0.7	0.7
Benzo(b)fluorene						
Benzo(ghi)perylene	30	30	30	1,000	2,500	2,500
Benzo(e)pyrine						
Benzo(k)fluoranthene	0.7	0.7	0.7	0.7	0.7	0.7
Benzo(j)fluoranthene						
Beryllium	0.4	0.8	3	0.4	0.8	3
β-BHC						
Δ-BHC						

Table 5. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Soil (S-1, S-2, S-3, GW-3) at the E&E Sites at Sudbury Training Annex[a]

Chemical	MCP Method 1[b] S-1 Soil + GW-3	MCP Method 1[b] S-2 Soil + GW-3	MCP Method 1[b] S-3 Soil + GW-3	MCP Method 2[c]		
				S-1 Soil	S-2 Soil	S-3 Soil
2-Butanone						
Cadmium	30	80	80	30	80	80
Calcium						
Camphor						
Carbazole						
Carbonic acid dimethyl ether						
α-Chlordane						
μ-Chlordane						
Chlorobenzene	40	40	40	500	1,000	2,500
Chloroform	100	200	300	100	200	500
Chromium	1,000	2,500	5,000	1,000	2,500	5,000
Chrysene	0.7	0.7	0.7	0.7	0.7	0.7
Cobalt						
Copper						
Cyclonite/hexahydro-1,3,5-trinitro-1,3-5-triazine/RDX						
Cyclotetramethylenetetranitramine/HMX						
Dacthal/DCPA						
p,p-DDD	2	3	10	2	3	10
p,p-DDE	2	2	9	2	2	9
p,p-DDT	2	2	9	2	2	9

Table 5. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Soil (S-1, S-2, S-3, GW-3) at the E&E Sites at Sudbury Training Annex[a]

Chemical	MCP Method 1[b] S-1 Soil + GW-3	MCP Method 1[b] S-2 Soil + GW-3	MCP Method 1[b] S-3 Soil + GW-3	MCP Method 2[c]		
				S-1 Soil	S-2 Soil	S-3 Soil
Dibenzofuran						
1,2-Dichloroethane	10	20	60	10	20	60
Dieldrin	0.03	0.04	0.1	0.03	0.04	0.2
Diethyl phthalate	0.7	0.7	0.7	1,000	2,500	5,000
1,3-Dimethylcyclohexane						
1,4-Dimethylcyclohexane						
1,3-Dimethylbenzene/m-xylene						
1,5-Dimethylnaphthalene						
2,4-Dinitrotoluene						
2,6-Dinitrotoluene						
Dioctyl adipate						
Endosulfan, A and sulfate						
Endosulfan, B						
Endrin	1	1	1	6	10	10
Ethylbenzene	500	500	500	500	1,000	2,500
1-Ethyl-2-methylbenzene						
Fluoranthene	600	600	600	900	2,000	5,000
Fluorene	900	400	1,000	800	2,000	5,000
Heptachlor	0.1	0.2	0.7	0.1	0.2	0.7
Heptachlor epoxide	0.06	0.09	0.3	0.06	0.09	0.3
Heptacosane						

Table 5. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Soil (S-1, S-2, S-3, GW-3) at the E&E Sites at Sudbury Training Annex[a]

Chemical	MCP Method 1[b] S-1 Soil + GW-3	MCP Method 1[b] S-2 Soil + GW-3	MCP Method 1[b] S-3 Soil + GW-3	MCP Method 2[c]		
				S-1 Soil	S-2 Soil	S-3 Soil
Heptadecane						
Hexachlorobiphenyls						
Hexadecane						
Hexadecanoic acid/Palmitic acid						
Hexamethylcyclotrisiloxane						
2,2,4,4,7,7-Hexamethyloctahydro-1H-indene						
2-Hexanone						
Hexatriacontane						
Hydrocarbons (all molecular weights)						
Indeno(1,2,3-cd)pyrene						
Iron						
Isophorone						
Lead	300	600	600	300	600	600
Lindane	0.4	0.5	0.5	0.4	0.6	2
Linoleic acid						
Magnesium						
Manganese						
Mercury	10	60	60	10	60	60
Mesityl oxide						
Methylene chloride	100	200	700	100	200	700

Table 5. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Soil (S-1, S-2, S-3, GW-3) at the E&E Sites at Sudbury Training Annex[a]

Chemical	MCP Method 1[b] S-1 Soil + GW-3	MCP Method 1[b] S-2 Soil + GW-3	MCP Method 1[b] S-3 Soil + GW-3	MCP Method 2[c]		
				S-1 Soil	S-2 Soil	S-3 Soil
4-Methyl-1-(1-methylethyl)-bicyclo[3,1,0]hex-2-ene						
2-Methylnaphthalene	7	7	7	1,000	2,500	2,500
3-Methylpentane						
Naphthalene	100	1,000	1,000	100	2,500	2,500
Nickel	300	700	700	300	700	700
Nitroglycerine						
2-Nitrotoluene						
3-Nitrotoluene						
Nonane						
Octadecanoic acid/ stearic acid						
Octane						
Oil and grease						
PCB-1242	2	2	2	2	2	2
PCB-1248	2	2	2	2	2	2
PCB-1254	2	2	2	2	2	2
PCB-1260	2	2	2	2	2	2
2,2',4,4',5-Pentachloro-1,1'-biphenyl						
2,3',4,4',5-Pentachloro-1,1'-biphenyl						
Pentaerythritol tetranitrate/PETN						
Pentatriacontane						

Table 5. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Soil (S-1, S-2, S-3, GW-3) at the E&E Sites at Sudbury Training Annex[a]

Chemical	MCP Method 1[b] S-1 Soil + GW-3	MCP Method 1[b] S-2 Soil + GW-3	MCP Method 1[b] S-3 Soil + GW-3	MCP Method 2[c]		
				S-1 Soil	S-2 Soil	S-3 Soil
Petroleum distillates						
Phenanthrene	100	100	100	1,000	2,500	2,500
Phenol	500	500	500	500	1,000	2,500
1-Phenylpropane/n-propylbenzene						
Phosphate						
α-Pinene						
Potassium						
2-Propanol						
Pyrene	500	500	500	700	2,000	5,000
Selenium	300	2,500	2,500	300	2,500	2,500
Silver	100	200	200	100	200	200
Sodium						
Steroids						
Sulfur						
Tetrachloroethylene/ tetrachloroethene	200	300	1,000	200	300	1,000
1,2,3,4-Tetramethylbenzene						
2,6,10,14-Tetramethylpentadecane						
Thallium	8	30	100	8	30	100
Toluene	500	1,000	2,500	500	1,000	2,500
Total organic carbon						

Table 5. Chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for Cleanup of Soil (S-1, S-2, S-3, GW-3) at the E&E Sites at Sudbury Training Annex[a]

Chemical	MCP Method 1[b] S-1 Soil + GW-3	MCP Method 1[b] S-2 Soil + GW-3	MCP Method 1[b] S-3 Soil + GW-3	MCP Method 2[c]		
				S-1 Soil	S-2 Soil	S-3 Soil
Total petroleum hydrocarbons	500	2,500	5,000	500	2,500	5,000
Total phosphates						
2,4,5-TP/silvex						
1,1,1-Trichloroethane	100	500	500	100	500	500
1,1,2-Trichloroethane	2	3	10	2	3	10
Trichloroethylene	70	100	500	70	100	500
Trichlorofluoromethane						
1,3,5-Trimethylbenzene						
1,7,7-Trimethylbicyclo[2,2,1] hept-2-ene						
1,1,3-Trimethylcyclohexane						
2,4,6-Trinitrotoluene						
Vanadium						
Xylenes, total	500	1,000	2,500	500	1,000	2,500
Zinc	2,500	2,500	5,000	2,500	2,500	5,000

[a] All values are in µg/g, Code of Massachusetts Regulations Title 310, Section 40.0975(6)(a-c); Section 40.0985(6), July 30, 1993; effective October 1, 1993.
[b] Direct contact exposure- and leachate-based soil concentrations.
[c] Direct contact exposure-based soil concentrations.

cants and slope factors (SFs) for carcinogens (USEPA 1988; 53 FR 51394, December 21, 1988). RfDs and SFs are available from the EPA IRIS database (USEPA 1994) and/or the annual EPA Health Effects Assessment Summary Tables (HEAST) (USEPA 1993a). Toxicity values for all detected chemicals at the E&E sites at the Annex are provided in Table 6.

Drinking Water HAs. Table 1 provides Lifetime Health Advisories and 10^{-6} cancer risk levels (USEPA 1993b) for all detected chemicals for which values are available. The Lifetime Health Advisories for chloromethane, dacthal, RDX, and 2,4,6-trinitrotoluene are the strictest among the TBC values and would, therefore, be used as guidance for cleanup of groundwater at the Annex. The Drinking Water Equivalent Level for sodium is the strictest among the TBC values and would, therefore, be used as guidance for cleanup of groundwater at the E&E sites at the Annex. These values are calculated assuming that an individual receives 80% of his exposure from sources other than consumption of drinking water.

SDWA NIPDWR/Proposed MCLs. Pursuant to the SDWA amendments of 1986, EPA has proposed an MCL and MCLG for sulfate (400,000/500,000 μg/L). The proposed value appeared in 55 FR 30370 (July 25, 1990). EPA is deferring setting a final MCL/MCLG for sulfate pending further study (57 FR 31776, July 17, 1992). However, it should be noted that the current stricter Massachusetts SMCL of 250,000 μg/L would be the relevant and appropriate requirement at this time. National Interim Primary Drinking Water Regulations (NIPDWR) have been established for arsenic and total trihalomethanes (40 FR 59570, December 24, 1975, effective June 24, 1976). The NIPDWR for arsenic matches the MMCL (see Table 1). According to the recent EPA Regulatory Agenda, an MCL for arsenic is expected to be proposed in September 1994 (58 FR 25034, April 26, 1993), with a final rule expected in September 1996. These values are currently listed as TBC guidance in Table 1; however, when the proposed MCLs are promulgated, they will be considered applicable or relevant and appropriate for cleanup of these chemicals in groundwater at the Annex.

Massachusetts ORSGs. The MDEP Office of Research and Standards issues guidance for chemicals for which state MCLs have not been promulgated. These guidelines apply to non-chlorinated water supplies and represent a level at or below which adverse, non-cancer health effects are unlikely to occur and which generally has associated with it an excess lifetime cancer risk of less than or equal to one in one million. SDWA MCLs that have been promulgated by EPA but are not yet effective are listed as ORSGs. ORSGs are listed in Table 1 for all detected chemicals for which values are available. The ORSG for tetrahydrofuran could be used as a guidance level for remediating groundwaters contaminated with this chemical at the Annex.

Calcium, Cobalt, Magnesium, Potassium, Sulfur, Vanadium. In lieu of any available criteria for cleanup of these elements, which can be considered essential nutrients, naturally-occurring levels (background) could be considered as a guidance for establishing cleanup levels.

In lieu of any available criteria for cleanup of the remaining chemicals detected in groundwater at the Annex, the USAEC will develop cleanup criteria using a risk assessment approach and the appropriate RfDs or SFs given in Table 6.

2.2.2. Surface Water and Sediment

Lead. For assessing the risk from exposure to lead in the sediments of the surface water bodies at the Annex, EPA's Uptake/Biokinetic Model can be used, upon approval of the EPA Regional Project Manager for the Annex. The model provides a multimedia exposure approach to estimate the percentage (may vary from region to region) of the exposed population (children, ages 0-6) with blood lead levels above a critical value of 10 μg/dL.

Dieldrin, Endrin, Fluoranthene, Phenanthrene. EPA's Office of Science and Technology has proposed Sediment Quality Criteria (SQC) for the protection of benthic organisms (59 FR 2652, January 18, 1994). The criteria states that benthic organisms should be acceptably protected in freshwater sediments containing 11 μg dieldrin/g organic carbon; 4.2 μg endrin/g organic carbon; 620 μg fluoranthene/g organic carbon; and 180 μg phenanthrene/g organic carbon. These criteria will apply to sediments with $\geq$ 0.2% organic carbon. EPA sources indicate that criteria for metals are currently under development.

In lieu of any available criteria for cleanup of the chemicals detected in surface waters at the Annex for which WQC are not available and for chemicals detected in contaminated sediments for which SQC are not available, the USAEC will develop surface water and sediment cleanup criteria using a risk assessment approach and the appropriate RfDs or SFs given in Table 6. The methodology outlined in RAGS (USEPA 1989) may be utilized to quantitate exposure pathways and risk to individuals from exposure via the pathways of concern at a particular site. In addition, cleanup criteria addressing ecological risk should be developed.

2.2.3. Soil

Lead. EPA has suggested cleanup values for lead in soils based on studies of blood lead levels in exposed children. The EPA OSWER Directive 9355.4-02 (dated September 7, 1989) recommends a cleanup level for soils of 500 to 1000 ppm lead. In addition, the Uptake/Biokinetic Model as described in Section 2.2.2 above may be used to assess the risk from lead exposure for current- or future-use exposure scenarios.

In lieu of any available criteria for cleanup of the chemicals detected in soils at the E&E Sites at the Annex for which Massachusetts MCP Method 1 and/or 2 Soil Standards are unavailable, the USAEC will develop soil cleanup criteria using a risk assessment approach and the appropriate RfDs or SFs given in Table 6. The methodology outlined in RAGS (USEPA 1989) may be utilized to quantitate exposure pathways and risk to individuals from exposure via the pathways of concern at a particular site. EPA Region IV has also provided some interim guidance to be used in determining the risks associated with dermal exposure to contaminated soils: a) dermal absorption factors of 1.0% for organics and 0.1% for inorganics: b) soil to skin adherence factors ranging from 0.2 to 1.0 mg/cm^2 (these factors differ from RAGS, based on new data) (USEPA 1992). Guidance can also be obtained from EPAs Dermal Exposure Assessment: Principles and Applications (EPA/600/8-91/011B, January 1992). Again, approval of the EPA Regional Project Manager for the Annex must be obtained for using these factors in the risk calculations.

Table 6. Reference Doses (RfDs), Reference Concentrations (RfCs), and Carcinogen Slope Factors (SF) for Chemicals Detected at the E&E Sites at Sudbury Training Annex[a]

Chemical	Oral RfD[b] (mg/kg/day)	Inhalation RfC[c] (mg/m^3)	Oral SF[d] $(mg/kg/day)^{-1}$	Inhalation SF $(mg/kg/day)^{-1}$	Weight-of-Evidence Class
Acenaphthene	6.0E-02	-	-	-	-
Acenaphthylene	-	-	-	-	-
Acetone	1.0E+00	-	-	-	D
Alcohol (high molecular weight)	-	-	-	-	-
Aldehydes	-	-	-	-	-
Aluminum	-	-	-	-	-
4-Amino-2,6-dinitrotoluene	-	-	-	-	-
4-Amino-4,6-dinitrotoluene	-	-	-	-	-
Anthracene	3.0E-01	-	-	-	D
Antimony	4.0E-04	-	-	-	-
Arsenic	3.0E-04	-	5.0E-05	5.0E-01	A
Athraquinone/9,10-anthracendione	-	-	-	-	-
Barium	7.0E-02	5.0E-04	-	-	-
BBNTHF	-	-	-	-	-
7H-Benz(de)anthracen-7-one	-	-	-	-	-
Benzene	-	-	2.9E-02	2.9E-02	A
Benzo(a)anthracene	-	-	-	-	-
Benzo(a)pyrene	-	-	7.3E+00	-	B2
Benzo(b)fluoranthene	-	-	-	-	B2
Benzo(b)fluorene	-	-	-	-	-
Benzo(ghi)fluoranthene	-	-	-	-	-
Benzo(ghi)perylene	-	-	-	-	D
Benzo(e)pyrine	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	B2
Benzo(j)fluoranthene	-	-	-	-	-
Beryllium	5.0E-03	-	4.3E+00	8.4E+00	B2
α-BHC	-	-	6.3E+00	6.3E+00	B2
β-BHC	-	-	1.8E+00	1.8E+00	C
Δ-BHC	-	-	-	-	D
Bicyclohexyl	-	-	-	-	-

Table 6. Reference Doses (RfDs), Reference Concentrations (RfCs), and Carcinogen Slope Factors (SF) for Chemicals Detected at the E&E Sites at Sudbury Training Annex[a]

Chemical	Oral RfD[b] (mg/kg/day)	Inhalation RfC[c] (mg/m^3)	Oral SF[d] $(mg/kg/day)^{-1}$	Inhalation SF $(mg/kg/day)^{-1}$	Weight-of-Evidence Class
N,N-*Bis*(2-hydroxyethyl)dodecanamide	-	-	-	-	-
2-Butanone	-	-	-	-	-
2-(2-N-Butoxyethoxy)ethanol	-	-	-	-	-
3-(T-Butyl)phenol	-	-	-	-	-
Cadmium	5.0E-04	-	-	6.1E+00	B1
Calcium	-	-	-	-	-
Camphor	-	-	-	-	-
Carbazole	-	-	2.0E-02	-	B2
Carbon disulfide	1.0E-01	1.0E-02	-	-	-
Carbonic acid dimethyl ether	-	-	-	-	-
α-Chlordane	6.0E-05	-	1.3E+00	1.3E+00	B2
μ-Chlordane	6.0E-05	-	1.3E+00	1.3E+00	B2
Chlorobenzene	2.0E-02	2.0E-02	-	-	D
Chloroform	1.0E-02	-	6.1E-03	8.1E-02	B2
Chloromethane	-	-	1.3E-02	6.3E-03	C
Chromium (IV)	5.0E-03	4.1E+01	-	-	A
Chromium (total)	1.0E+00	-	-	-	-
Chrysene	-	-	-	-	B2
Cobalt	-	-	-	-	-
Copper	-	-	-	-	D
Cyclohexanol	-	-	-	-	-
Cyclonite/hexahydro-1,3,5-trinitro-1,3-5-triazine/RDX	3.0E-03	-	1.1E-01	-	C
Cyclotetramethylenetetranitramine/HMX	-	-	-	-	-
Dacthal/DCPA	5.0E-01	-	-	-	-
p,p-DDD	-	-	2.4E-01	-	B2
p,p-DDE	-	-	3.4E-01	-	B2
p,p-DDT	5.0E-04	-	3.4E-01	3.4E-01	B2
Dibenzo(a,h)anthracene	-	-	-	-	B2
Dibenzofuran	-	-	-	-	-

Table 6. Reference Doses (RfDs), Reference Concentrations (RfCs), and Carcinogen Slope Factors (SF) for Chemicals Detected at the E&E Sites at Sudbury Training Annex[a]

Chemical	Oral RfD[b] (mg/kg day)	Inhalation RfC[c] (mg/m^3)	Oral SF[d] $(mg/kg/day)^{-1}$	Inhalation SF $(mg/kg/day)^{-1}$	Weight-of-Evidence Class
1,3-Dichlorobenzene	-	-	-	-	D
1,1-Dichloroethane	1.0E-01	5.0E-01	-	-	C
1,2-Dichloroethane	-	-	9.1E-02	9.1E-02	B2
Dieldrin	5.0E-05	-	1.6E+01	1.6E+01	B2
N,N-Diethyl-3-methylbenzamide	-	-	-	-	-
Diethyl phthalate	8.0E-01	-	-	-	D
Dimethyoxy dimethylsilane	-	-	-	-	-
1,3-Dimethylbenzene/m-xylene	2.0E+00	-	-	-	-
1,4-Dimethylbenzene	-	-	-	-	-
Dimethylbenzene sulfonamide	-	-	-	-	-
1,3-Dimethylcyclohexane	-	-	-	-	-
1,4-Dimethylcyclohexane	-	-	-	-	-
1,5-Dimethylnaphthalene	-	-	-	-	-
2,4-Dinitrotoluene	2.0E-03	-	6.8E-01	-	B2
2,6-Dinitrotoluene	1.0E-03	-	6.8E-01	-	B2
Dioctyl adipate	-	-	-	-	-
Dodecanoic acid/lauic acid	-	-	-	-	-
2E1HXL	-	-	-	-	-
1-Eicosanol	-	-	-	-	-
Endosulfan A	6.0E-03	-	-	-	-
Endosulfan B	-	-	-	-	-
Endosulfan sulfate	-	-	-	-	-
Endrin	3.0E-04	-	-	-	D
Endrin aldehyde	-	-	-	-	-
Ethylbenzene	1.0E-01	1.0E+00	-	-	D
Ethyl methyl benzene	-	-	-	-	-
1-Ethyl-2-methylbenzene	-	-	-	-	-
Fluoranthene	4.0E-02	-	-	-	D
Fluorene	4.0E-02	-	-	-	D
Heptachlor	5.0E-04	-	4.5E+00	4.5E+00	B2

Table 6. Reference Doses (RfDs), Reference Concentrations (RfCs), and Carcinogen Slope Factors (SF) for Chemicals Detected at the E&E Sites at Sudbury Training Annex[a]

Chemical	Oral RfD[b] (mg/kg/day)	Inhalation RfC[c] (mg/m^3)	Oral SF[d] $(mg/kg/day)^{-1}$	Inhalation SF $(mg/kg/day)^{-1}$	Weight-of-Evidence Class
Heptachlor epoxide	1.3E-05	-	9.1E+00	9.1E+00	B2
Heptacosane	-	-	-	-	-
Heptadecane	-	-	-	-	-
Hexachlorobiphenyls	-	-	-	-	-
Hexadecane	-	-	-	-	-
Hexadecanoic acid/Palmitic acid	-	-	-	-	-
Hexamethylcyclotrisiloxane	-	-	-	-	-
2,2,4,4,7,7-Hexamethyloctahydro-1H-indene	-	-	-	-	-
2-Hexanone	-	-	-	-	-
Hexatriacontane	-	-	-	-	-
Hydrocarbons (all molecular weights)	-	-	-	-	-
4-Hydroxyl-4-methyl-2-pentanone	-	-	-	-	-
Indan/Hydrindene	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	-	-	B2
Iron	-	-	-	-	-
Isophorone	2.0E-01	-	9.5E-04	-	C
Lead	-	-	-	-	B2
Lindane	3.0E-04	-	1.3E+00	-	B2
Linoleic acid	-	-	-	-	-
Magnesium	-	-	-	-	-
Manganese	1.0E-01 [5.0E-03 (water)]	5.0E-05	-	-	D
Mercury	3.0E-04	3.0E-04	-	-	D
Mesityl oxide	-	-	-	-	-
2-(2-Methoxyethoxy)ethanol	-	-	-	-	-
2-Methoxy-1-propene	-	-	-	-	-
Methylene chloride	6.0E-02	3.0E+00	7.5E-03	-	B2
1-Methylindan	-	-	-	-	-
Methyl isobutyl ketone	8.0E-02	8.0E-02	-	-	-

Table 6. Reference Doses (RfDs), Reference Concentrations (RfCs), and Carcinogen Slope Factors (SF) for Chemicals Detected at the E&E Sites at Sudbury Training Annex[a]

Chemical	Oral RfD[b] (mg/kg/day)	Inhalation RfC[c] (mg/m^3)	Oral SF[d] $(mg/kg/day)^{-1}$	Inhalation SF $(mg/kg/day)^{-1}$	Weight-of-Evidence Class
4-Methyl-1-(1-methylethyl)-bicyclo[3,1,0]hex-2-ene	-	-	-	-	-
1-Methylnapthalene	-	-	-	-	-
2-Methylnaphthalene	-	-	-	-	-
4-Methylphenanthrene	-	-	-	-	-
3-Methylpentane	-	-	-	-	-
4-Methylphenol	-	-	-	-	-
2-Methylpropanoic acid, 3-hydroxy-2,4,4-trimethylpentyl ester	-	-	-	-	-
7-Methyltridecane	-	-	-	-	-
Myristic acid/tetradecanoic acid	-	-	-	-	-
Naphthalene	-	-	-	-	D
Nickel	2.0E-02	-	-	-	-
Nitrate	1.6E+00	-	-	-	-
Nitrobenzene	5.0E-04	2.0E-03	-	-	D
Nitroglycerine	-	-	-	-	-
N-Nitrosodipropylamine	-	-	4.9E-03	-	B2
2-Nitrotoluene	1.0E-02	-	-	-	-
3-Nitrotoluene	1.0E-02	-	-	-	-
4-Nitrotoluene	1.0E-02	-	-	-	-
Nonadecane	-	-	-	-	-
Nonane	-	-	-	-	-
Octadecanoic acid/ stearic acid	-	-	-	-	-
Octane	-	-	-	-	-
Oil and grease	-	-	-	-	-
PAHs	-	-	-	-	-
PCB-1242	-	-	7.7E+00	-	B2
PCB-1248	-	-	7.7E+00	-	B2
PCB-1254	-	-	7.7E+00	-	B2
PCB-1260	-	-	7.7E+00	-	B2
2,2',4,4',5-Pentachloro-1,1'-biphenyl	-	-	-	-	-

Table 6. Reference Doses (RfDs), Reference Concentrations (RfCs), and Carcinogen Slope Factors (SF) for Chemicals Detected at the E&E Sites at Sudbury Training Annex[a]

Chemical	Oral RfD[b] (mg/kg/day)	Inhalation RfC[c] (mg/m^3)	Oral SF[d] $(mg/kg/day)^{-1}$	Inhalation SF $(mg/kg/day)^{-1}$	Weight-of-Evidence Class
2,3',4,4',5-Pentachloro-1,1'-biphenyl	-	-	-	-	-
Pentadecanoic acid	-	-	-	-	-
Pentaerythritol tetranitrate/PETN	-	-	-	-	-
Pentatriacontane	-	-	-	-	-
Petroleum distillates	-	-	-	-	-
Phenanthrene	-	-	-	-	D
Phenol	6.0E-01	-	-	-	D
Phenol-D5	-	-	-	-	-
Phenoxyacietic acid	-	-	-	-	-
2-Phenoxyethanol	-	-	-	-	-
2-(2-N-Phenoxyethoxy)ethanol	-	-	-	-	-
1-Phenylpropane/n-propylbenzene	-	-	-	-	-
Phosphate	-	-	-	-	-
α-Pinene	-	-	-	-	-
Potassium	-	-	-	-	-
2-Propanol	-	-	-	-	-
Pyrene	3.0E-02	-	-	-	D
Selenium	5.0E-03	-	-	-	D
Silver	5.0E-03	-	-	-	D
Sodium	-	-	-	-	-
Steroids	-	-	-	-	-
(3β)-Stigmast-5-en-3-ol	-	-	-	-	-
Sulfur	-	-	-	-	-
Supraene/spinacene/squalene	-	-	-	-	-
1,1,2,2-Tetrachloroethane	-	-	2.0E-01	2.0E-01	C
Tetrachloroethylene/tetrachloroethene	1.0E-02	-	-	-	B2
Tetracosane	-	-	-	-	-
1,2,3,4-Tetramethylbenzene	-	-	-	-	-
2,6,10,14-Tetramethylpentadecane	-	-	-	-	-
Thallium	-	-	-	-	-

Table 6. Reference Doses (RfDs), Reference Concentrations (RfCs), and Carcinogen Slope Factors (SF) for Chemicals Detected at the E&E Sites at Sudbury Training Annex[a]

Chemical	Oral RfD[b] (mg/kg/day)	Inhalation RfC[c] (mg/m^3)	Oral SF[d] $(mg/kg/day)^{-1}$	Inhalation SF $(mg/kg/day)^{-1}$	Weight-of-Evidence Class
Toluene	2.0E-01	4.0E-01	-	-	D
Total organic carbon	-	-	-	-	-
Total petroleum hydrocarbons	-	-	-	-	-
Total phosphates	-	-	-	-	-
2,4,5-TP/silvex	-	-	-	-	-
1,1,1-Trichloroethane	-	-	-	-	D
1,1,2-Trichloroethane	4.0E-03	-	5.7E-02	5.7E-02	C
Trichloroethylene	-	-	-	-	-
Trichlorofluoromethane	3.0E-01	7.0E-01	-	-	-
1,2,3-Trimethlbenzene	-	-	-	-	-
1,3,5-Trimethylbenzene	-	-	-	-	-
Trimethlbenzenes	-	-	-	-	-
1,7,7-Trimethylbicyclo[2,2,1]hept-2-ene	-	-	-	-	-
1,1,3-Trimethylcyclohexane	-	-	-	-	-
2,2,4-Trimethyl-1,3-pentanediol	-	-	-	-	-
1,3,5-Trinitrobenzene	5.0E-05	-	-	-	-
2,4,6-Trinitrotoluene	5.0E-04	-	3.0E-02	-	C
Vanadium	7.0E-03	-	-	-	-
Xylenes, total	2.0E+00	-	-	-	D
Zinc	3.0E-01	-	-	-	D

[a]From IRIS (USEPA 1994) and HEAST (USEPA 1993).
[b]RfD = Chronic Reference Dose.
[c]RfC = Chronic Reference Concentration.
[d]SF = Carcinogen Slope Factor.

3. REFERENCES

Blain, P. 1994. Massachusetts Department of Environmental Protection, Division of Water Supply. Personal communication, February 23, 1994 (617-292-5948).

EEI. Ecology and Environment, Inc. 1993. Master Environmental Plan, Fort Devens Sudbury Training Annex, Massachusetts (Draft Report). Contract No. DAAA15-90-D-0012. Ecology and Environment, Inc., Arlington, VA.

Hogan, P. 1992. Environmental Engineer, Technical Services Branch, NPDES Permit Program, Massachusetts Department of Environmental Protection, Worcester, MA. Personal communication, May 5, 1992 (508-792-7470).

USEPA. U.S. Environmental Protection Agency. 1988. CERCLA Compliance with Other Laws Manual, Draft Guidance, Vol. I. OSWER Directive 9234.1001. Office of Solid Waste and Emergency Response, Washington, DC.

USEPA. U.S. Environmental Protection Agency. 1989. Risk Assessment Guidance for Superfund, Volume I. Human Health Evaluation Manual. Office of Emergency and Remedial Response, Washington, DC. EPA/540/1-89/002.

USEPA. U.S. Environmental Protection Agency. 1992. New interim Region IV guidance. Letter received February 11, 1992. Region IV, Atlanta, GA.

USEPA. U.S. Environmental Protection Agency. 1993a. Health Effects Assessment Summary Tables. Annual, FY-1993, Supplement No. 1 (July 1993), Supplement No. 2 (November 1993). OERR 9200.6-303-(93-1). Office of Emergency and Remedial Response, Washington, DC.

USEPA. U.S. Environmental Protection Agency. 1993b. Drinking Water Regulations and Health Advisories. Office of Drinking Water, Washington, DC. (Current as of December 1993).

USEPA. U.S. Environmental Protection Agency. 1994. Integrated Risk Information System (IRIS). Office of Health and Environmental Assessment. U.S. Environmental Protection Agency. EPA/600/8-86/032a.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region III
841 Chestnut Street
Philadelphia, Pennsylvania 19107

July 11, 1994

SUBJECT: Risk-Based Concentration Table, Third Quarter 1994

FROM: Roy L. Smith, Ph.D., Senior Toxicologist
Technical Support Section (3HW13)

TO: RBC Table mailing list

Attached is the EPA Region III risk-based concentration (RBC) table, which we have distributed quarterly to all interested parties since 1991. If you are not currently on the mailing list, but would like to be, please contact Anna Poulton (phone: 215-597-3179, fax: 215-597-9890) and give her your name, address, and phone and fax numbers.

The table contains reference doses and carcinogenic potency slopes (obtained from IRIS through July 1, 1994, HEAST through November March 1994, the Superfund Health Risk Technical Support Center, and other EPA sources) for nearly 600 chemicals. These toxicity constants have been combined with "standard" exposure scenarios to calculate RBCs - chemical concentrations corresponding to fixed levels of risk (*i.e.*, a hazard quotient of 1, or lifetime cancer risk of 10^{-6}, whichever occurs at a lower concentration) in water, air, fish tissue, and soil.

The Region III toxicologists use the table to screen sites not yet on the NPL, respond rapidly to citizen inquiries, and spot-check formal baseline risk assessments. The background materials provide the complete basis for all the calculations, with the intent of showing users exactly how the RBCs were developed. Simply put, RBCs are risk assessments run in reverse. For a single contaminant in a single medium, under standard default exposure assumptions, the RBC corresponds to the target risk or hazard quotient.

The calculations also have several important limitations. Specifically excluded from consideration are (1) transfers from soil to air and groundwater, and (2) cumulative risk from multiple contaminants or media. Also, the toxicity information in the table has been assembled by hand, and (despite extensive checking and years of use) may contain errors. It's advisable to cross-check before relying on any RfDs or CPSs in the table. If you find any errors, please send me a note.

Lately, many callers have asked whether the risk-based concentrations can be used as valid no-action levels or cleanup levels, especially for soils.. The answer is a bit complex. First, it is important to realize that the RBC table does not constitute regulation or guidance, and should not be viewed as a substitute for a site-specific risk assessment. For sites where:

1. A single medium is contaminated;

2. A single contaminant contributes nearly all of the health risk;

3. Volatilization or leaching of that contaminant from soil is expected not to be significant;

4. The exposure scenarios used in the RBC table are appropriate for the site;

5. The fixed risk levels used in the RBC table are appropriate for the site; and

6. Risk to ecological receptors is expected not to be significant;

the risk-based concentrations would probably be protective as no-action levels or cleanup goals. However, to the extent that a site deviates from this description, as most do, the RBCs would not necessarily be appropriate.

To summarize, the table should generally not be used to (1) set cleanup or no-action levels at CERCLA or RCRA Corrective Action sites, (2) substitute for EPA guidance for preparing baseline risk assessments, or (3) determine if a waste is hazardous under RCRA.

This issue of the RBC table includes new toxicity constants and media concentrations, which are marked on the table in underlined boldface print. On pg. 4, the source of the toxicological constants labeled "ECAO-Cincinnati" has been clarified.

I get many telephone calls about the RBC table, but am often unable to answer the phone. Many of you have the same problem, so we play a lot of "phone tag". Last quarter, I suggested that you fax me (at 215-597-9890) your technical questions and concerns, so I could respond by return fax. This has worked very well for me, and I hope you have been satisfied with my responses. I would like to continue this method. Of course, if you don't have access to a fax machine, I will also continue to respond to voice mail messages.

Attachment

Risk-Based Concentration Table
Background Information

General: Separate carcinogenic and non-carcinogenic risk-based concentrations were calculated for each compound for each pathway. The concentration in the table is the lower of the two, rounded to two significant figures. The following terms and values were used in the calculations:

Exposure variables	Value	Name
1-General:		
Carcinogenic potency slope oral (risk per mg/kg/d):	*	CPSo
Carcinogenic potency slope inhaled (risk per mg/kg/d):	*	CPSi
Reference dose oral (mg/kg/d):	*	RfDo
Reference dose inhaled (mg/kg/d):	*	RfDi
Target cancer risk:	1e-06	TR
Target hazard quotient:	1	THQ
Body weight, adult (kg):	70	BWa
Body weight, age 1-6 (kg):	15	BWc
Averaging time carcinogens (d):	25550	ATc
Averaging time non-carcinogens (d):	ED*365	ATn
Inhalation, adult (m3/d):	20	IRAa
Inhalation, child (m3/d):	12	IRAc
Inhalation factor, age-adjusted (m3-y/kg-d):	11.66	IFAadj
Tap water ingestion, adult (L/d):	2	IRWa
Tap water ingestion, age 1-6 (L/d):	1	IRWc
Tap water ingestion factor, age-adjusted (L-y/kg-d):	1.09	IFWadj
Fish ingestion (g/d):	54	IRF
Soil ingestion, adult (mg/d):	100	IRSa
Soil ingestion, age 1-6 (mg/d):	200	IRSc
Soil ingestion factor, age adjusted (mg-y/kg-d):	114.29	IFSadj
2-Residential:		
Exposure frequency (d/y):	350	EFr
Exposure duration, total (y):	30	EDtot

Exposure variables	Value	Name
Exposure duration, age 1-6 (y):	6	EDc
Volatilization factor (L/m3):	0.5	VF
3-Occupational:		
Exposure frequency (d/y):	250	EFo
Exposure duration (y):	25	EDo
* = Contaminant-specific toxicity parameters		

The priority among sources of toxicological constants was as follows: (1) IRIS, (2) HEAST, (3) HEAST alternative method, (4) EPA Superfund Health Risk Technical Support Center, (5) withdrawn from IRIS or HEAST, and (6) other EPA documents. Each source was used only if numbers from higher-priority sources were unavailable. The EPA Superfund Health Risk Technical Support Center, part of the Chemical Mixtures Branch of ECAO-Cincinnati, develops provisional RfDs and CPSs on request for contaminants not in IRIS or HEAST. These provisional values are labeled "e = EPA-ECAO provisional" in the table. It is possible they may be obsolete. If one of the "e" constants is important to a Superfund risk assessment, consider requesting, through a Regional risk assessor, a new provisional value.

Algorithms:

1. Age-adjusted factors: Because contact rates with tap water, ambient air, and residential soil are different for children and adults, carcinogenic risks during the first 30 years of life were calculated using age-adjusted factors. These factors approximated the integrated exposure from birth until age 30 by combining contact rates, body weights, and exposure durations for two age groups - small children and adults. The age-adjusted factor for soil was obtained from RAGS IB; the others were developed by analogy.

a. Air inhalation ($[m^3 \cdot y]/[kg \cdot d]$):

$$IFAadj = \frac{EDc \cdot IRAc}{BWc} + \frac{(EDtot - EDc) \cdot IRAa}{BWa}$$

b. Tap water ingestion ($[L \cdot y]/[kg \cdot d]$):

$$IFWadj = \frac{EDc \cdot IRWc}{BWc} + \frac{(EDtot - EDc) \cdot IRWa}{BWa}$$

c. Soil ingestion ([mg · y]/[kg · d]):

$$IFSadj = \frac{EDc \cdot IRSc}{BWc} + \frac{(EDtot - EDc) \cdot IRSa}{BWa}$$

2. Residential water use (µg/L). Volatilization terms were calculated only for compounds with "***" in the "VOC" column. Compounds having a Henry's Law constant greater than 10^{-5} were considered volatile. The list may be incomplete, but is unlikely to include false positives. The equations and the volatilization factor (VF, above) were obtained from RAGS IB. Oral potency slopes and reference doses were used for both oral and inhaled exposures for volatile compounds lacking inhalation values. Inhaled potency slopes were substituted for unavailable oral potency slopes only for volatile compounds; inhaled RfDs were substituted for unavailable oral RfDs for both volatile and non-volatile compounds.

a. Carcinogens: Calculations were based on combined childhood and adult exposure.

$$\frac{TR \cdot ATc \cdot 1000 \frac{ug}{mg}}{EFr \cdot ([VF \cdot IFAadj \cdot CPSi] + [IFWadj \cdot CPSo])}$$

b. Non-carcinogens: Calculations were based on adult exposure.

$$\frac{THQ \cdot BWa \cdot ATn \cdot 1000 \frac{ug}{mg}}{EFr \cdot EDtot \cdot \left(\frac{VF \cdot IRAa}{RfDi} + \frac{IRWa}{RfDo}\right)}$$

3. Air (µg/m^3). Oral potency slopes and references were used where inhalation values were not available.

a. Carcinogens: Calculations were based on combined childhood and adult exposure.

$$\frac{TR \cdot ATc \cdot 1000 \frac{ug}{mg}}{EFr \cdot IFAadj \cdot CPSi}$$

b. Non-carcinogens: Calculations were based on adult exposure.

$$\frac{THQ \cdot RfDi \cdot BWa \cdot ATn \cdot 1000 \frac{ug}{mg}}{EFr \cdot EDtot \cdot IRAa}$$

4. Fish (mg/kg):

a. Carcinogens: Calculations were based on adult exposure.

$$\frac{TR \cdot BWa \cdot ATc}{EFr \cdot EDtot \cdot \dfrac{IRF}{1000\ \frac{g}{kg}} \cdot CPSo}$$

b. Non-carcinogens: Calculations were based on adult exposure.

$$\frac{THQ \cdot RfDo \cdot BWa \cdot ATn}{EFr \cdot EDtot \cdot \dfrac{IRF}{1000\ \frac{g}{kg}}}$$

5. Soil commercial/industrial (mg/kg): The default exposure assumption that only 50% of incidental soil ingestion occurs at work has been omitted. Calculations were based on adult occupational exposure.

a. Carcinogens:

$$\frac{TR \cdot BWa\ ATc}{EFo \cdot EDo \cdot \dfrac{IRSa}{10^6\ \frac{mg}{kg}} \cdot CPSo}$$

b. Non-carcinogens:

$$\frac{THQ \cdot RfDo \cdot BWa \cdot ATn}{EFo \cdot EDo \cdot \dfrac{IRSa}{10^6\ \frac{mg}{kg}}}$$

6. Soil residential (mg/kg):

a. Carcinogens: Calculations were based on combined childhood and adult exposure.

$$\frac{TR \cdot ATc}{EFr \cdot \dfrac{IFSadj}{10^6\ \frac{mg}{kg}} \cdot CPSo}$$

b. Non-carcinogens: Calculations were based on childhood exposure only.

$$\frac{THQ \cdot RfDo \cdot BWc \cdot ATn}{EFr \cdot EDc \cdot \dfrac{IRSc}{10^6\ \frac{mg}{kg}}}$$

Sources: i=IRIS h=HEAST a=HEAST alt. w=Withdrawn from IRIS or HEAST e=EPA-ECAO provisional o=Other EPA documents   *Basis of RBC: c=carcinogenic effects n=noncarcinogenic effects.*

Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg·d/mg	CPSi kg·d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
Acephate	30560191	4.00E-03 i		8.70E-03 i			7.7 c	0.72 c	0.36 c	330 c	73 c
Acetaldehyde	75070		2.57E-03 i		7.70E-03 i		94 n	0.81 c			
Acetochlor	34256821	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Acetone	67641	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Acetone cyanohydrin	75865	7.00E-02 h	2.86E-03 e				2600 n	10 n	95 n	72000 n	5500 n
Acetonitrile	75078	6.00E-03 i	1.43E-02 e				220 n	52 n	8.1 n	6100 n	470 n
Acetophenone	98862	1.00E-01 i	5.71E-06 w			***	0.042 n	0.021 n	140 n	100000 n	7800 n
Acifluorfen	62476599	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Acrolein	107028	2.00E-02 h	5.71E-06 i				730 n	0.021 n	27 n	20000 n	1600 n
Acrylamide	79061	2.00E-04 i		4.50E+00 i	4.55E+00 i		0.015 c	0.0014 c	0.0007 c	0.64 c	0.14 c
Acrylic acid	79107	5.00E-01 i	1.00E-03 i				18000 n	3.7 n	680 n	510000 n	39000 n
Acrylonitrile	107131	1.00E-03 h	5.71E-04 i	5.40E-01 i	2.38E-01 i		0.12 c	0.026 c	0.0058 c	5.3 c	1.2 c
Alachlor	15972608	1.00E-02 i		8.00E-02 h			0.84 c	0.078 c	0.039 c	36 c	8 c
Alar	1596845	1.50E-01 i					5500 n	550 n	200 n	150000 n	12000 n
Aldicarb	116063	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Aldicarb sulfone	1646884	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Aldrin	309002	3.00E-05 i		1.70E+01 i	1.71E+01 i		0.004 c	0.00037 c	0.00019 c	0.17 c	0.038 c
Ally	74223646	2.50E-01 i					9100 n	910 n	340 n	260000 n	20000 n
Allyl alcohol	107186	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Allyl chloride	107051	5.00E-02 w	2.86E-04 i				1800 n	1 n	68 n	51000 n	3900 n
Aluminum phosphide	20859738	4.00E-04 i					15 n	1.5 n	0.54 n	410 n	31 n
Amdro	67485294	3.00E-04 i					11 n	1.1 n	0.41 n	310 n	23 n
Ametryn	834128	9.00E-03 i					330 n	33 n	12 n	9200 n	700 n
m-Aminophenol	591275	7.00E-02 h					2600 n	260 n	95 n	72000 n	5500 n
4-Aminopyridine	504245	2.00E-05 h					0.73 n	0.073 n	0.027 n	20 n	1.6 n
Amitraz	33089611	2.50E-03 i					91 n	9.1 n	3.4 n	2600 n	200 n
Ammonia	7664417		2.86E-02 i				1000 n	100 n			
Ammonium sulfamate	7773060	2.00E-01 i					7300 n	730 n	270 n	200000 n	16000 n
Aniline	62533		2.86E-04 i	5.70E-03 i			10 n	1 n	0.55 c	500 c	110 c
Antimony and compounds	7440360	4.00E-04 i					15 n	1.5 n	0.54 n	410 n	31 n
Antimony pentoxide	1314609	5.00E-04 h					18 n	1.8 n	0.68 n	510 n	39 n
Antimony potassium tartrate	304610	9.00E-04 h					33 n	3.3 n	1.2 n	920 n	70 n
Antimony tetroxide	1332316	4.00E-04 h					15 n	1.5 n	0.54 n	410 n	31 n
Antimony trioxide	1309644	4.00E-04 h					15 n	1.5 n	0.54 n	410 n	31 n
Apollo	74115245	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Aramite	140578	5.00E-02 h		2.50E-02 i	2.49E-02 i		2.7 c	0.25 c	0.13 c	110 c	26 c
Arsenic	7440382	3.00E-04 i					11 n	1.1 n	0.41 n	310 n	23 n
Arsenic (as carcinogen)	7440382			1.75E+00 i	1.51E+01 i		0.038 c	0.00041 c	0.0018 c	1.6 c	0.37 c
Arsine	7784421		1.43E-05 i				0.52 n	0.052 n			
Assure	76578148	9.00E-03 i					330 n	33 n	12 n	9200 n	700 n
Asulam	3337711	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Atrazine	1912249	3.50E-02 i		2.22E-01 h			0.3 c	0.028 c	0.014 c	13 c	2.9 c

Sources: i=IRIS h=HEAST a=HEAST alt. w=Withdrawn from IRIS or HEAST e=EPA-ECAO provisional o=Other EPA documents

Basis of RBC: c=carcinogenic effects n=noncarcinogenic effects.

Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg-d/mg	CPSi kg-d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
Avermectin B1	65195553	4.00E-04 i					15 n	1.5 n	0.54 n	410 n	31 n
Azobenzene	103333			1.10E-01 i	1.08E-01 i		0.61 c	0.058 c	0.029 c	26 c	5.8 c
Barium and compounds	7440393	7.00E-02 i	1.43E-04 a				2600 n	0.52 n	95 n	72000 n	5500 n
Baygon	114261	4.00E-03 i					150 n	15 n	5.4 n	4100 n	310 n
Bayleton	43121433	3.00E-02 i					1100 n	110 n	41 n	31000 n	2300 n
Baythroid	68359375	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Benefin	1861401	3.00E-01 i					11000 n	1100 n	410 n	310000 n	23000 n
Benomyl	17804352	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Bentazon	25057890	2.50E-03 i					91 n	9.1 n	3.4 n	2600 n	200 n
Benzaldehyde	100527	1.00E-01 i				***	610 n	370 n	140 n	100000 n	7800 n
Benzene	71432		1.71E-03 e	2.90E-02 i	2.90E-02 i	***	0.36 c	0.22 c	0.11 c	99 c	22 c
Benzenethiol	108985	1.00E-05 h					0.37 n	0.037 n	0.014 n	10 n	0.78 n
Benzidine	92875	3.00E-03 i		2.30E+02 i	2.35E+02 i		0.00029 c	0.000027 c	0.000014 c	0.012 c	0.0028 c
Benzoic acid	65850	4.00E+00 i					150000 n	15000 n	5400 n	1000000 n	310000 n
Benzotrichloride	98077			1.30E+01 i			0.0052 c	0.00048 c	0.00024 c	0.22 c	0.049 c
Benzyl alcohol	100516	3.00E-01 h					11000 n	1100 n	410 n	310000 n	23000 n
Benzyl chloride	100447			1.70E-01 i		***	0.062 c	0.037 c	0.019 c	17 c	3.8 c
Beryllium and compounds	7440417	5.00E-03 i		4.30E+00 i	8.40E+00 i		0.016 c	0.00075 c	0.00073 c	0.67 c	0.15 c
Bidrin	141662	1.00E-04 i					3.7 n	0.37 n	0.14 n	100 n	7.8 n
Biphenthrin (Talstar)	82657043	1.50E-02 i					550 n	55 n	20 n	15000 n	1200 n
1,1-Biphenyl	92524	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Bis(2-chloroisopropyl)ether	39638329	4.00E-02 i		7.00E-02 h	3.50E-02 h	***	0.26 c	0.18 c	0.045 c	41 c	9.1 c
Bis(chloromethyl)ether	542881			2.20E+02 i	2.17E+02 i	***	0.000049 c	0.000029 c	0.000014 c	0.013 c	0.0029 c
Bis(2-chloro-1-methylethyl)ether				7.00E-02 w	7.00E-02 w		0.96 c	0.089 c	0.045 c	41 c	9.1 c
Bis(2-ethylhexyl)phthalate (DEHP)	117817	2.00E-02 i		1.40E-02 i			4.8 c	0.45 c	0.23 c	200 c	46 c
Bis(chloroethyl)ether	111444			1.10E+00 i	1.16E+00 i	***	0.0092 c	0.0054 c	0.0029 c	2.6 c	0.58 c
Bisphenol A	80057	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Boron (and borates)	7440428	9.00E-02 i	5.71E-03 h				3300 n	21 n	120 n	92000 n	7000 n
Boron trifluoride	7637072		2.00E-04 h				7.3 n	0.73 n			
Bromodichloromethane	75274	2.00E-02 i		6.20E-02 i		***	0.17 c	0.1 c	0.051 c	46 c	10 c
Bromoethene	593602				1.10E-01 h	***	0.096 c	0.057 c			
Bromoform (tribromomethane)	75252	2.00E-02 i		7.90E-03 i	3.85E-03 i	***	2.4 c	1.6 c	0.4 c	360 c	81 c
Bromomethane	74839	1.40E-03 i	1.43E-03 i			***	8.7 n	5.2 n	1.9 n	1400 n	110 n
4-Bromophenyl phenyl ether	101553	5.80E-02 o					2100 n	210 n	78 n	59000 n	4500 n
Bromophos	2104963	5.00E-03 h					180 n	18 n	6.8 n	5100 n	390 n
Bromoxynil	1689845	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Bromoxynil octanoate	1689992	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
1,3-Butadiene	106990				9.80E-01 i	***	0.011 c	0.0064 c			
1-Butanol	71363	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Butyl benzyl phthalate	85687	2.00E-01 i					7300 n	730 n	270 n	200000 n	16000 n
Bu[illegible]	2008415	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
sec[illegible]zene	135988	1.00E-02 e				***	61 n	37 n	14 n	100[illegible]	780 n

Sources: i=IRIS h=HEAST a=HEAST alt. w=Withdrawn from IRIS or HEAST e=EPA-ECAO provisional o=Other EPA documents   *Basis of RBC: c=carcinogenic effects n=noncarcinogenic effects.*

Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg·d/mg	CPSi kg·d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
tert-Butylbenzene	104518	1.00E-02 e				•••	61 n	37 n	14 n	10000 n	780 n
Butylphthalyl butylglycolate	85701	1.00E+00 i					37000 n	3700 n	1400 n	1000000 n	78000 n
Cacodylic acid	75605	3.00E-03 h					110 n	11 n	4.1 n	3100 n	230 n
Cadmium and compounds	7440439	5.00E-04 i			6.30E+00 i		18 n	0.00099 c	0.68 n	510 n	39 n
Caprolactam	105602	5.00E-01 i					18000 n	1800 n	680 n	510000 n	39000 n
Captafol	2425061	2.00E-03 i		8.60E-03 h			7.8 c	0.73 c	0.37 c	330 c	74 c
Captan	133062	1.30E-01 i		3.50E-03 h			19 c	1.8 c	0.9 c	820 c	180 c
Carbaryl	63252	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Carbazole	86748			2.00E-02 h			3.4 c	0.31 c	0.16 c	140 c	32 c
Carbofuran	1563662	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Carbon disulfide	75150	1.00E-01 i	2.86E-03 h			•••	21 n	10 n	140 n	100000 n	7800 n
Carbon tetrachloride	56235	7.00E-04 i	5.71E-04 e	1.30E-01 i	5.25E-02 i	•••	0.16 c	0.12 c	0.024 c	22 c	4.9 c
Carbosulfan	55285148	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
Carboxin	5234684	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Chloral	75876	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Chloramben	133904	1.50E-02 i					550 n	55 n	20 n	15000 n	1200 n
Chloranil	118752			4.03E-01 h			0.17 c	0.016 c	0.0078 c	7.1 c	1.6 c
Chlordane	57749	6.00E-05 i		1.30E+00 i	1.29E+00 i		0.052 c	0.0049 c	0.0024 c	2.2 c	0.49 c
Chlorimuron-ethyl	90982324	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Chlorine	7782505	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Chlorine dioxide	10049044		5.71E-05 i				2.1 n	0.21 n			
Chloroacetaldehyde	107200	6.90E-03 o					250 n	25 n	9.3 n	7100 n	540 n
Chloroacetic acid	79118	2.00E-03 h					73 n	7.3 n	2.7 n	2000 n	160 n
2-Chloroacetophenone	532274		8.57E-06 i				0.31 n	0.031 n			
4-Chloroaniline	106478	4.00E-03 i					150 n	15 n	5.4 n	4100 n	310 n
Chlorobenzene	108907	2.00E-02 i	5.71E-03 e			•••	39 n	21 n	27 n	20000 n	1600 n
Chlorobenzilate	510156	2.00E-02 i		2.70E-01 h	2.70E-01 h		0.25 c	0.023 c	0.012 c	11 c	2.4 c
p-Chlorobenzoic acid	74113	2.00E-01 h					7300 n	730 n	270 n	200000 n	16000 n
4-Chlorobenzotrifluoride	98566	2.00E-02 h					730 n	73 n	27 n	20000 n	1600 n
2-Chloro-1,3-butadiene	126998	2.00E-02 a	2.00E-03 h			•••	14 n	7.3 n	27 n	20000 n	1600 n
1-Chlorobutane	109693	4.00E-01 h				•••	2400 n	1500 n	540 n	410000 n	31000 n
Chlorodifluoromethane	75456		1.43e+01 i			•••	87000 n	52000 n			
Chloroethane	75003	4.00E-01 e	2.86E+00 i			•••	8600 n	10000 n	540 n	410000 n	31000 n
2-Chloroethyl vinyl ether	110758	2.50E-02 o				•••	150 n	91 n	34 n	26000 n	2000 n
Chloroform	67663	1.00E-02 i		6.10E-03 i	8.05E-02 i	•••	0.15 c	0.078 c	0.52 c	470 c	100 c
Chloromethane	74873			1.30E-02 h	6.30E-03 h	•••	1.4 c	0.99 c	0.24 c	220 c	49 c
4-Chloro-2,2-methylaniline hydrochloride	3165933			4.60E-01 h			0.15 c	0.014 c	0.0069 c	6.2 c	1.4 c
4-Chloro-2-methylaniline	95692			5.80E-01 h			0.12 c	0.011 c	0.0054 c	4.9 c	1.1 c
beta-Chloronaphthalene	91587	8.00E-02 i					2900 n	290 n	110 n	82000 n	6300 n
o-Chloronitrobenzene	88733			2.50E-02 h		•••	0.42 c	0.25 c	0.13 c	110 c	26 c
p-Chloronitrobenzene	100005			1.80E-02 h		•••	0.59 c	0.35 c	0.18 c	160 c	35 c
2-Chlorophenol	95578	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n

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2-Chloropropane	75296		2.86E-02 h			***	170 n	100 n			
Chlorothalonil	1897456	1.50E-02 i		1.10E-02 h			6.1 c	0.57 c	0.29 c	260 c	58 c
o-Chlorotoluene	95498	2.00E-02 i				***	120 n	73 n	27 n	20000 n	1600 n
Chlorpropham	101213	2.00E-01 i					7300 n	730 n	270 n	200000 n	16000 n
Chlorpyrifos	2921882	3.00E-03 i					110 n	11 n	4.1 n	3100 n	230 n
Chlorpyrifos-methyl	5598130	1.00E-02 h					370 n	37 n	14 n	10000 n	780 n
Chlorsulfuron	64902723	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Chlorthiophos	60238564	8.00E-04 h					29 n	2.9 n	1.1 n	820 n	63 n
Chromium III and compounds	16065831	1.00E+00 i	5.71E-07 w				37000 n	0.0021 n	1400 n	1000000 n	78000 n
Chromium VI and compounds	7440473	5.00E-03 i			4.20E+01 i		180 n	0.00015 c	6.8 n	5100 n	390 n
Coal tar	8001589				2.20E+00 w			0.0028 c			
Cobalt	7440484	6.00E-02 e					2200 n	220 n	81 n	61000 n	4700 n
Coke Oven Emissions	8007452				2.17E+00 i			0.0029 c			
Copper and compounds	7440508	3.71E-02 h					1400 n	140 n	50 n	38000 n	2900 n
Crotonaldehyde	123739	1.00E-02 w		1.90E+00 h	1.90E+00 w		0.035 c	0.0033 c	0.0017 c	1.5 c	0.34 c
Cumene	98828	4.00E-02 i	2.57E-03 h				1500 n	9.4 n	54 n	41000 n	3100 n
Cyanides:											
Barium cyanide	542621	1.00E-01 w					3700 n	370 n	140 n	100000 n	7800 n
Calcium cyanide	592018	4.00E-02 i					1500 n	150 n	54 n	41000 n	3100 n
Copper cyanide	544923	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Cyanazine	21725462	2.00E-03 h		8.40E-01 h			0.08 c	0.0075 c	0.0038 c	3.4 c	0.76 c
Cyanogen	460195	4.00E-02 i					1500 n	150 n	54 n	41000 n	3100 n
Cyanogen bromide	506683	9.00E-02 i					3300 n	330 n	120 n	92000 n	7000 n
Cyanogen chloride	506774	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Free cyanide	57125	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Hydrogen cyanide	74908	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Potassium cyanide	151508	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Potassium silver cyanide	506616	2.00E-01 i					7300 n	730 n	270 n	200000 n	16000 n
Silver cyanide	506649	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Sodium cyanide	143339	4.00E-02 i					1500 n	150 n	54 n	41000 n	3100 n
Zinc cyanide	557211	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Cyclohexanone	108941	5.00E+00 i				***	30000 n	18000 n	6800 n	1000000 n	390000 n
Cyclohexlamine	108918	2.00E-01 i					7300 n	730 n	270 n	200000 n	16000 n
Cyhalothrin/Karate	68085858	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Cypermethrin	52315078	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
Cyromazine	66215278	7.50E-03 i					270 n	27 n	10 n	7700 n	590 n
Dacthal	1861321	5.00E-01 i					18000 n	1800 n	680 n	510000 n	39000 n
Dalapon	75990	3.00E-02 i					1100 n	110 n	41 n	31000 n	2300 n
Danitol	39515418	5.00E-04 w					18 n	1.8 n	0.68 n	510 n	39 n
DDD	72548			2.40E-01 i			0.28 c	0.026 c	0.013 c	12 c	2.7 c
DDE	72559			3.40E-01 i			0.2 c	0.018 c	0.0093 c	8.4 c	1.9 c
DDT	50293	5.00E-04 i		3.40E-01 i	3.40E-01 i		0.2 c	0.018 c	0.0093 c	[illegible]	1.9 c

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Decabromodiphenyl ether	1163195	1.00E-02 i				***	61 n	37 n	14 n	10000 n	780 n
Demeton	8065483	4.00E-05 i					1.5 n	0.15 n	0.054 n	41 n	3.1 n
Diallate	2303164			6.10E-02 h		***	0.17 c	0.1 c	0.052 c	47 c	10 c
Diazinon	333415	9.00E-04 h					33 n	3.3 n	1.2 n	920 n	70 n
1,4-Dibromobenzene	106376	1.00E-02 i				***	61 n	37 n	14 n	10000 n	780 n
Dibromochloromethane	124481	2.00E-02 i		8.40E-02 i		***	0.13 c	0.075 c	0.038 c	34 c	7.6 c
1,2-Dibromo-3-chloropropane	96128		5.71E-05 i	1.40E+00 h	2.42E-03 h	***	0.048 c	0.21 n	0.0023 c	2 c	0.46 c
1,2-Dibromoethane	106934		5.71E-05 h	8.50E+01 i	7.70E-01 i	***	0.00075 c	0.0081 c	0.000037 c	0.034 c	0.0075 c
Dibutyl phthalate	84742	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Dicamba	1918009	3.00E-02 i					1100 n	110 n	41 n	31000 n	2300 n
1,2-Dichlorobenzene	95501	9.00E-02 i	5.71E-02 e			***	370 n	210 n	120 n	92000 n	7000 n
1,3-Dichlorobenzene	541731	8.90E-02 o				***	540 n	320 n	120 n	91000 n	7000 n
1,4-Dichlorobenzene	106467		2.29E-01 i	2.40E-02 h		***	0.44 c	0.26 c	0.13 c	120 c	27 c
3,3'-Dichlorobenzidine	91941			4.50E-01 i			0.15 c	0.014 c	0.007 c	6.4 c	1.4 c
1,4-Dichloro-2-butene	764410				9.30E+00 h	***	0.0011 c	0.00067 c			
Dichlorodifluoromethane	75718	2.00E-01 i	5.71E-02 e			***	390 n	210 n	270 n	200000 n	16000 n
1,1-Dichloroethane	75343	1.00E-01 h	1.43E-01 e			***	810 n	520 n	140 n	100000 n	7800 n
1,2-Dichloroethane (EDC)	107062		2.86E-03 e	9.10E-02 i	9.10E-02 i	***	0.12 c	0.069 c	0.035 c	31 c	7 c
1,1-Dichloroethylene	75354	9.00E-03 i		6.00E-01 i	1.75E-01 i	***	0.044 c	0.036 c	0.0053 c	4.8 c	1.1 c
1,2-Dichloroethylene (cis)	156592	1.00E-02 h				***	61 n	37 n	14 n	10000 n	780 n
1,2-Dichloroethylene (trans)	156605	2.00E-02 i				***	120 n	73 n	27 n	20000 n	1600 n
1,2-Dichloroethylene (mixture)	540590	9.00E-03 h				***	55 n	33 n	12 n	9200 n	700 n
2,4-Dichlorophenol	120832	3.00E-03 i					110 n	11 n	4.1 n	3100 n	230 n
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	1.00E-02 i				***	61 n	37 n	14 n	10000 n	780 n
4-(2,4-Dichlorophenoxy)butyric Acid	94826	8.00E-03 i					290 n	29 n	11 n	8200 n	630 n
1,2-Dichloropropane	78875		1.14E-03 i	6.80E-02 h		***	0.16 c	0.092 c	0.046 c	42 c	9.4 c
2,3-Dichloropropanol	616239	3.00E-03 i					110 n	11 n	4.1 n	3100 n	230 n
1,3-Dichloropropene	542756	3.00E-04 i	5.71E-03 i	1.75E-01 h	1.30E-01 h	***	0.077 c	0.048 c	0.018 c	16 c	3.7 c
Dichlorvos	62737	5.00e-04 i	1.43E-04 i	2.90E-01 i			0.23 c	0.022 c	0.011 c	9.9 c	2.2 c
Dicofol	115322			4.40E-01 w			0.15 c	0.014 c	0.0072 c	6.5 c	1.5 c
Dicyclopentadiene	77736	3.00E-02 h	5.71E-05 e			***	0.42 n	0.21 n	41 n	31000 n	2300 n
Dieldrin	60571	5.00E-05 i		1.60E+01 i	1.61E+01 i		0.0042 c	0.00039 c	0.0002 c	0.18 c	0.04 c
Diesel emissions			1.43E-03 i				52 n	5.2 n			
Diethyl phthalate	84662	8.00E-01 i					29000 n	2900 n	1100 n	820000 n	63000 n
Diethylene glycol, monobutyl ether	112345		5.71E-03 h				210 n	21 n			
Diethylene glycol, monoethyl ether	111900	2.00E+00 h					73000 n	7300 n	2700 n	1000000 n	160000 n
Diethylformamide	617845	1.10E-02 h					400 n	40 n	15 n	11000 n	860 n
Di(2-ethylhexyl)adipate	103231	6.00E-01 i		1.20E-03 i			56 c	5.2 c	2.6 c	2400 c	530 c
Diethylstilbestrol	56531			4.70E+03 h			0.000014 c	1.30E-06 c	6.70E-07 c	0.00061 c	0.00014 c
Difenzoquat (Avenge)	43222486	8.00E-02 i					2900 n	290 n	110 n	82000 n	6300 n
Diflubenzuron	35367385	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Diisopropyl methylphosphonate (DIMP)	1445756	8.00E-02 i					2900 n	290 n	110 n	82000 n	6300 n

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Dimethipin	55290647	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Dimethoate	60515	2.00E-04 i					7.3 n	0.73 n	0.27 n	200 n	16 n
3,3'-Dimethoxybenzidine	119904			1.40E-02 h			4.8 c	0.45 c	0.23 c	200 c	46 c
Dimethyl phthalate	131113	1.00E+01 h					370000 n	37000 n	14000 n	1000000 n	780000 n
Dimethyl terephthalate	120616	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Dimethylamine	124403		5.71E-06 w				0.21 n	0.021 n			
2,4-Dimethylaniline hydrochloride	21436964			5.80E-01 h			0.12 c	0.011 c	0.0054 c	4.9 c	1.1 c
2,4-Dimethylaniline	95681			7.50E-01 h			0.09 c	0.0083 c	0.0042 c	3.8 c	0.85 c
N-N-Dimethylaniline	121697	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
3,3'-Dimethylbenzidine	119937			9.20E+00 h			0.0073 c	0.00068 c	0.00034 c	0.31 c	0.069 c
N,N-Dimethylformamide	68122	1.00E-01 h	8.57E-03 i				3700 n	31 n	140 n	100000 n	7800 n
1,1-Dimethylhydrazine	57147			2.60E+00_	3.50E+00_		0.026 c	0.0018 c	0.0012 c	1.1 c	0.25 c
1,2-Dimethylhydrazine	540738			3.70E+01 w	3.70E+01 w		0.0018 c	0.00017 c	0.000085 c	0.077 c	0.017 c
2,4-Dimethylphenol	105679	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
2,6-Dimethylphenol	576261	6.00E-04 i					22 n	2.2 n	0.81 n	610 n	47 n
3,4-Dimethylphenol	95658	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
1,2-Dinitrobenzene	528290	4.00E-04 h					15 n	1.5 n	0.54 n	410 n	31 n
1,3-Dinitrobenzene	99650	1.00E-04 i					3.7 n	0.37 n	0.14 n	100 n	7.8 n
1,4-Dinitrobenzene	100254	4.00E-04 h					15 n	1.5 n	0.54 n	410 n	31 n
4,6-Dinitro-o-cyclohexyl phenol	131895	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
2,4-Dinitrophenol	51285	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Dinitrotoluene mixture				6.80E-01 i			0.099 c	0.0092 c	0.0046 c	4.2 c	0.94 c
2,4-Dinitrotoluene	121142	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
2,6-Dinitrotoluene	606202	1.00E-03 h					37 n	3.7 n	1.4 n	1000 n	78 n
Dinoseb	88857	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
di-n-Octyl phthalate	117840	2.00E-02 h					730 n	73 n	27 n	20000 n	1600 n
1,4-Dioxane	123911			1.10E-02 i			6.1 c	0.57 c	0.29 c	260 c	58 c
Diphenamid	957517	3.00E-02 i					1100 n	110 n	41 n	31000 n	2300 n
Diphenylamine	122394	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
1,2-Diphenylhydrazine	122667			8.00E-01 i	7.70E-01 i		0.084 c	0.0081 c	0.0039 c	3.6 c	0.8 c
Diquat	85007	2.20E-03 i					80 n	8 n	3 n	2200 n	170 n
Direct black 38	1937377			8.60E+00 h			0.0078 c	0.00073 c	0.00037 c	0.33 c	0.074 c
Direct blue 6	2602462			8.10E+00 h			0.0083 c	0.00077 c	0.00039 c	0.35 c	0.079 c
Direct brown 95	16071866			9.30E+00 h			0.0072 c	0.00067 c	0.00034 c	0.31 c	0.069 c
Disulfoton	298044	4.00E-05 i					1.5 n	0.15 n	0.054 n	41 n	3.1 n
1,4-Dithiane	505293	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
Diuron	330541	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Dodine	2439103	4.00E-03 i					150 n	15 n	5.4 n	4100 n	310 n
Endosulfan	115297	6.00E-03 h					220 n	22 n	8.1 n	6100 n	470 n
Endothall	145733	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Endr[illegible]	72208	3.00E-04 i					11 n	1.1 n	0.41 n	310 [illegible]	23 n
Epi[illegible]rin	106898	2.00E-03 h	2.86E-0[illegible]	[illegible].90E-03 i	4.20E-03 i		6.8 c	1 n	0.32 c	[illegible]	65 c

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1,2-Epoxybutane	106887		5.71E-03 i				210 n	21 n			
Ethephon (2-chloroethyl phosphonic acid)	16672870	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Ethion	563122	5.00E-04 i					18 n	1.8 n	0.68 n	510 n	39 n
2-Ethoxyethanol acetate	111159	3.00E-01 e					11000 n	1100 n	410 n	310000 n	23000 n
2-Ethoxyethanol	110805	4.00E-01 h	5.71E-02 i				15000 n	210 n	540 n	410000 n	31000 n
Ethyl acrylate	140885			4.80E-02 h			1.4 c	0.13 c	0.066 c	60 c	13 c
EPTC (S-Ethyl dipropylthiocarbamate)	759944	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Ethyl ether	60297	2.00E-01 i				•••	1200 n	730 n	270 n	200000 n	16000 n
Ethyl methacrylate	97632	9.00E-02 h					3300 n	330 n	120 n	92000 n	7000 n
Ethyl acetate	141786	9.00E-01 i					33000 n	3300 n	1200 n	920000 n	70000 n
Ethylbenzene	100414	1.00E-01 i	2.86E-01 i			•••	1300 n	1000 n	140 n	100000 n	7800 n
Ethylene cyanohydrin	109784	3.00E-01 h					11000 n	1100 n	410 n	310000 n	23000 n
Ethylene diamine	107153	2.00E-02 h					730 n	73 n	27 n	20000 n	1600 n
Ethylene glycol	107211	2.00E+00 i					73000 n	7300 n	2700 n	1000000 n	160000 n
Ethylene glycol, monobutyl ether	111762		5.71E-03 h				210 n	21 n			
Ethylene oxide	75218			1.02E+00 h	3.50E-01 h		0.066 c	0.018 c	0.0031 c	2.8 c	0.63 c
Ethylene thiourea (ETU)	96457	8.00E-05 i		1.19E-01 h			0.57 c	0.053 c	0.027 c	24 c	5.4 c
Ethyl p-nitrophenyl phenylphosphorothioate	2104645	1.00E-05 i					0.37 n	0.037 n	0.014 n	10 n	0.78 n
Ethylnitrosourea	759739			1.40E+02 w			0.00048 c	0.000045 c	0.000023 c	0.02 c	0.0046 c
Ethylphthalyl ethyl glycolate	84720	3.00E+00 i					110000 n	11000 n	4100 n	1000000 n	230000 n
Express	10120	8.00E-03 i					290 n	29 n	11 n	8200 n	630 n
Fenamiphos	22224926	2.50E-04 i					9.1 n	0.91 n	0.34 n	260 n	20 n
Fluometuron	2164172	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Fluoride	7782414	6.00E-02 i					2200 n	220 n	81 n	61000 n	4700 n
Fluoridone	59756604	8.00E-02 i					2900 n	290 n	110 n	82000 n	6300 n
Flurprimidol	56425913	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Flutolanil	66332965	6.00E-02 i					2200 n	220 n	81 n	61000 n	4700 n
Fluvalinate	69409945	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
Folpet	133073	1.00E-01 i		3.50E-03 i			19 c	1.8 c	0.9 c	820 c	180 c
Fomesafen	72178020			1.90E-01 i			0.35 c	0.033 c	0.017 c	15 c	3.4 c
Fonofos	944229	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Formaldehyde	50000	2.00E-01 i			4.55E-02 i		7300 n	0.14 c	270 n	200000 n	16000 n
Formic Acid	64186	2.00E+00 h					73000 n	7300 n	2700 n	1000000 n	160000 n
Fosetyl-al	39148248	3.00E+00 i					110000 n	11000 n	4100 n	1000000 n	230000 n
Furan	110009	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Furazolidone	67458			3.80E+00 h			0.018 c	0.0016 c	0.00083 c	0.75 c	0.17 c
Furfural	98011	3.00E-03 i	1.43E-02 e				110 n	52 n	4.1 n	3100 n	230 n
Furium	531828			5.00E+01 h			0.0013 c	0.00013 c	0.000063 c	0.057 c	0.013 c
Furmecyclox	60568050			3.00E-02 i			2.2 c	0.21 c	0.11 c	95 c	21 c
Glufosinate-ammonium	77182822	4.00E-04 i					15 n	1.5 n	0.54 n	410 n	31 n
Glycidaldehyde	765344	4.00E-04 i	2.86E-04 h				15 n	1 n	0.54 n	410 n	31 n
Glyphosate	1071836	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n

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Haloxyfop-methyl	69806402	5.00E-05 i					1.8 n	0.18 n	0.068 n	51 n	3.9 n
Harmony	79277273	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
HCH (alpha)	319846			6.30E+00 i	6.30E+00 i		0.011 c	0.00099 c	0.0005 c	0.45 c	0.1 c
HCH (beta)	319857			1.80E+00 i	1.80E+00 i		0.037 c	0.0035 c	0.0018 c	1.6 c	0.35 c
HCH (gamma) Lindane	58899	3.00E-04 i		1.30E+00 h			0.052 c	0.0048 c	0.0024 c	2.2 c	0.49 c
HCH-technical	608731			1.80E+00 i	1.79E+00 i		0.037 c	0.0035 c	0.0018 c	1.6 c	0.35 c
Heptachlor	76448	5.00E-04 i		4.50E+00 i	4.55E+00 i	●●●	0.0023 c	0.0014 c	0.0007 c	0.64 c	0.14 c
Heptachlor epoxide	1024573	1.30E-05 i		9.10E+00 i	9.10E+00 i	●●●	0.0012 c	0.00069 c	0.00035 c	0.31 c	0.07 c
Hexabromobenzene	87821	2.00E-03 i				●●●	12 n	7.3 n	2.7 n	2000 n	160 n
Hexachlorobenzene	118741	8.00E-04 i		1.60E+00 i	1.61E+00 i	●●●	0.0066 c	0.0039 c	0.002 c	1.8 c	0.4 c
Hexachlorobutadiene	87683	2.00E-04 h		7.80E-02 i	7.70E-02 i	●●●	0.14 c	0.081 c	0.04 c	37 c	8.2 c
Hexachlorocyclopentadiene	77474	7.00E-03 i	2.00E-05 h			●●●	0.15 n	0.073 n	9.5 n	7200 n	550 n
Hexachlorodibenzo-p-dioxin mixture	19408743			6.20E+03 i	4.55E+03 i		0.000011 c	1.40E-06 c	5.10E-07 c	0.00046 c	0.0001 c
Hexachloroethane	67721	1.00E-03 i		1.40E-02 i	1.40E-02 i	●●●	0.75 c	0.45 c	0.23 c	200 c	46 c
Hexachlorophene	70304	3.00E-04 i					11 n	1.1 n	0.41 n	310 n	23 n
Hexahydro-1,3,5-trinitro-1,3,5-triazine	121824	3.00E-03 i		1.10E-01 i			0.61 c	0.057 c	0.029 c	26 c	5.8 c
n-Hexane	110543	6.00E-02 h	5.71E-02 i			●●●	350 n	210 n	81 n	61000 n	4700 n
Hexazinone	51235042	3.30E-02 i					1200 n	120 n	45 n	34000 n	2600 n
Hydrazine, hydrazine sulfate	302012			3.00E+00 i	1.71E+01 i		0.022 c	0.00037 c	0.0011 c	0.95 c	0.21 c
Hydrogen chloride	7647010		2.00E-03 i				73 n	7.3 n			
Hydrogen sulfide	7783064	3.00E-03 i	2.57E-04 i				110 n	0.94 n	4.1 n	3100 n	230 n
Hydroquinone	123319	4.00E-02 h					1500 n	150 n	54 n	41000 n	3100 n
Imazalil	35554440	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Imazaquin	81335377	2.50E-01 i					9100 n	910 n	340 n	260000 n	20000 n
Iprodione	36734197	4.00E-02 i					1500 n	150 n	54 n	41000 n	3100 n
Isobutanol	78831	3.00E-01 i				●●●	1800 n	1100 n	410 n	310000 n	23000 n
Isophorone	78591	2.00E-01 i		9.50E-04 i			71 c	6.6 c	3.3 c	3000 c	670 c
Isopropalin	33820530	1.50E-02 i					550 n	55 n	20 n	15000 n	1200 n
Isopropyl methyl phosphonic acid	1832548	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Isoxaben	82558507	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Kepone	143500			1.80E+01 ●			0.0037 c	0.00035 c	0.00018 c	0.16 c	0.035 c
Lactofen	77501634	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Lead (tetraethyl)	78002	1.00E-07 i					0.0037 n	0.00037 n	0.00014 n	0.1 n	0.0078 n
Linuron	330552	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Lithium	7439932	2.00E-02 ●					730 n	73 n	27 n	20000 n	1600 n
Londax	83056996	2.00E-01 i					7300 n	730 n	270 n	200000 n	16000 n
Malathion	121755	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Maleic anhydride	108316	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Maleic hydrazide	123331	5.00E-01 i					18000 n	1800 n	680 n	510000 n	39000 n
Malononitrile	109773	2.00E-05 h					0.73 n	0.073 n	0.027 n	20 n	1.6 n
Mancozeb	8018017	3.00E-02 h					1100 n	110 n	41 n	31000 n	2300 n
Ma[illegible]	12427382	5.00E-03 i					180 n	18 n	6.8 n	51[illegible]	390 n

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Manganese and compounds	7439965	5.00E-03 i	1.43e-05 i				180 n	0.052 n	6.8 n	5100 n	390 n
Mephosfolan	950107	9.00E-05 h					3.3 n	0.33 n	0.12 n	92 n	7 n
Mepiquat chloride	24307264	3.00E-02 i					1100 n	110 n	41 n	31000 n	2300 n
Mercury (inorganic)	7439976	3.00E-04 h	8.57E-05 h				11 n	0.31 n	0.41 n	310 n	23 n
Mercury (methyl)	22967926	3.00E-04 i					11 n	1.1 n	0.41 n	310 n	23 n
Merphos	150505	3.00E-05 i					1.1 n	0.11 n	0.041 n	31 n	2.3 n
Merphos oxide	78488	3.00E-05 i					1.1 n	0.11 n	0.041 n	31 n	2.3 n
Metalaxyl	57837191	6.00E-02 i					2200 n	220 n	81 n	61000 n	4700 n
Methacrylonitrile	126987	1.00E-04 i	2.00E-04 e				3.7 n	0.73 n	0.14 n	100 n	7.8 n
Methamidophos	10265926	5.00E-05 i					1.8 n	0.18 n	0.068 n	51 n	3.9 n
Methanol	67561	5.00E-01 i					18000 n	1800 n	680 n	510000 n	39000 n
Methidathion	950378	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Methomyl	16752775	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Methoxychlor	72435	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
2-Methoxyethanol acetate	110496	2.00E-03 e					73 n	7.3 n	2.7 n	2000 n	160 n
2-Methoxyethanol	109864	1.00E-03 h	5.71E-03 i				37 n	21 n	1.4 n	1000 n	78 n
2-Methoxy-5-nitroaniline	99592			4.60E-02 h			1.5 c	0.14 c	0.069 c	62 c	14 c
Methyl acetate	79209	1.00E+00 h					37000 n	3700 n	1400 n	1000000 n	78000 n
Methyl acrylate	96333	3.00E-02 e					1100 n	110 n	41 n	31000 n	2300 n
2-Methylaniline hydrochloride	636215			1.80E-01 h			0.37 c	0.035 c	0.018 c	16 c	3.5 c
2-Methylaniline	95534			2.40E-01 h			0.28 c	0.026 c	0.013 c	12 c	2.7 c
Methyl chlorocarbonate	79221	1.00E+00 w					37000 n	3700 n	1400 n	1000000 n	78000 n
4-(2-Methyl-4-chlorophenoxy) butyric acid	94815	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
2-Methyl-4-chlorophenoxyacetic acid	94746	5.00E-04 i					18 n	1.8 n	0.68 n	510 n	39 n
2-(2-Methyl-14-chlorophenoxy)propionic acid	93652	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Methylcyclohexane	108872		8.57E-01 h				31000 n	3100 n			
Methylene bromide	74953	1.00E-02 e				***	61 n	37 n	14 n	10000 n	780 n
Methylene chloride	75092	6.00E-02 i	8.57E-01 h	7.50E-03 i	1.64E-03 i	***	4.1 c	3.8 c	0.42 c	380 c	85 c
4,4'-Methylene bis(2-chloroaniline)	101144	7.00E-04 h		1.30E-01 h	1.30E-01 h		0.52 c	0.048 c	0.024 c	22 c	4.9 c
4,4'-Methylenebisbenzeneamine	101779			2.50E-01 w			0.27 c	0.025 c	0.013 c	11 c	2.6 c
4,4'-Methylene bis(N,N'-dimethyl)aniline	101611			4.60E-02 i			1.5 c	0.14 c	0.069 c	62 c	14 c
4,4'-Methylenediphenyl isocyanate	101688		5.71E-06 i			***	0.035 n	0.021 n			
Methyl ethyl ketone	78933	6.00E-01 i	2.86E-01 i				22000 n	1000 n	810 n	610000 n	47000 n
Methyl hydrazine	60344			1.10E+00_			0.061 c	0.0057 c	0.0029 c	2.6 c	0.58 c
Methyl isobutyl ketone	108101	8.00E-02 h	2.29E-02 e				2900 n	84 n	110 n	82000 n	6300 n
Methyl methacrylate	80626	8.00E-02 h					2900 n	290 n	110 n	82000 n	6300 n
2-Methyl-5-nitroaniline	99558			3.30E-02 h			2 c	0.19 c	0.096 c	87 c	19 c
Methyl parathion	298000	2.50E-04 i					9.1 n	0.91 n	0.34 n	260 n	20 n
2-Methylphenol (o-cresol)	95487	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
3-Methylphenol (m-cresol)	103394	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
4-Methylphenol (p-cresol)	106445	5.00E-03 h					180 n	18 n	6.8 n	5100 n	390 n
Methyl styrene (mixture)	25013154	6.00E-03 e	1.14E-02 e			***	60 n	42 n	8.1 n	6100 n	470 n

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Methyl styrene (alpha)	98839	7.00E-02 e				•••	430 n	260 n	95 n	72000 n	5500 n
Methyl tertbutyl ether (MTBE)	1634044	5.00E-03 e	8.57E-01 i			•••	180 n	3100 n	6.8 n	5100 n	390 n
Metolaclor (Dual)	51218452	1.50E-01 h					5500 n	550 n	200 n	150000 n	12000 n
Metribuzin	21807649	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Mirex	2385855	2.00E-04 i		1.80E+00 w			0.037 c	0.0035 c	0.0018 c	1.6 c	0.35 c
Molinate	2212671	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Molybdenum	7439987	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Monochloramine	10599903	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Naled	300765	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
2-Naphthylamine	**91598**			**1.30e+02 e**			**0.00052 c**	**0.000048 c**	**0.000024 c**	**0.022 c**	**0.0049 c**
Napropamide	15299997	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Nickel refinery dust					8.40E-01 i			0.0075 c			
Nickel (soluble salts)	7440020	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Nickel subsulfide	12035722				1.70E+00 i			0.0037 c			
Nitrapyrin	1929824	1.50E-03 w					55 n	5.5 n	2 n	1500 n	120 n
Nitrate	14797558	1.60E+00 i					58000 n	5800 n	2200 n	1000000 n	130000 n
Nitric Oxide	10102439	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
Nitrite	14797650	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
2-Nitroaniline	88744	6.00E-05 w	5.71E-05 h				2.2 n	0.21 n	0.081 n	61 n	4.7 n
3-Nitroaniline	99092	3.00E-03 o					110 n	11 n	4.1 n	3100 n	230 n
4-Nitroaniline	100016	3.00E-03 o					110 n	11 n	4.1 n	3100 n	230 n
Nitrobenzene	98953	5.00E-04 i	5.71E-04 e			•••	3.4 n	2.1 n	0.68 n	510 n	39 n
Nitrofurantoin	67209	7.00E-02 h					2600 n	260 n	95 n	72000 n	5500 n
Nitrofurazone	59870			1.50E+00 h	9.40E+00 h		0.045 c	0.00067 c	0.0021 c	1.9 c	0.43 c
Nitrogen dioxide	10102440	1.00E+00 i					37000 n	3700 n	1400 n	1000000 n	78000 n
Nitroguanidine	556887	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
4-Nitrophenol	100027	6.20E-02 o					2300 n	230 n	84 n	63000 n	4800 n
2-Nitropropane	79469		5.71E-03 i		9.40E+00 h		210 n	0.00067 c			
N-Nitrosodi-n-butylamine	924163			5.40E+00 i	5.60E+00 i		0.012 c	0.0011 c	0.00058 c	0.53 c	0.12 c
N-Nitrosodiethanolamine	1116547			2.80E+00 i			0.024 c	0.0022 c	0.0011 c	1 c	0.23 c
N-Nitrosodiethylamine	55185			1.50E+02 i	1.51E+02 i		0.00045 c	0.000041 c	0.000021 c	0.019 c	0.0043 c
N-Nitrosodimethylamine	62759			5.10E+01 i	4.90E+01 i		0.0013 c	0.00013 c	0.000062 c	0.056 c	0.013 c
N-Nitrosodiphenylamine	86306			4.90E-03 i			14 c	1.3 c	0.64 c	580 c	130 c
N-Nitroso di-n-propylamine	621647			7.00E+00 i			0.0096 c	0.00089 c	0.00045 c	0.41 c	0.091 c
N-Nitroso-N-methylethylamine	10595956			2.20E+01 i			0.0031 c	0.00028 c	0.00014 c	0.13 c	0.029 c
N-Nitrosopyrrolidine	930552			2.10E+00 i	2.13E+00 i		0.032 c	0.0029 c	0.0015 c	1.4 c	0.3 c
m-Nitrotoluene	99081	1.00E-02 h				•••	61 n	37 n	14 n	10000 n	780 n
o-Nitrotoluene	88722	1.00E-02 h				•••	61 n	37 n	14 n	10000 n	780 n
p-Nitrotoluene	99990	1.00E-02 h				•••	61 n	37 n	14 n	10000 n	780 n
Norflurazon	27314132	4.00E-02 i					1500 n	150 n	54 n	41000 n	3100 n
NuStar	85509199	7.00E-04 i					26 n	2.6 n	0.95 n	720 n	55 n
Octab[illegible]iphenyl ether	32536520	3.00E-03 i					110 n	11 n	4.1 n	3100	230 n

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Octahydro-1357-tetranitro-1357-tetrazocine	2691410	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Octamethylpyrophosphoramide	152169	2.00E-03 h					73 n	7.3 n	2.7 n	2000 n	160 n
Oryzalin	19044883	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Oxadiazon	19666309	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Oxamyl	23135220	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Oxyfluorfen	42874033	3.00E-03 i					110 n	11 n	4.1 n	3100 n	230 n
Paclobutrazol	76738620	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Paraquat	1910425	4.50E-03 i					160 n	16 n	6.1 n	4600 n	350 n
Parathion	56382	6.00E-03 h					220 n	22 n	8.1 n	6100 n	470 n
Pebulate	1114712	5.00E-02 h					1800 n	180 n	68 n	51000 n	3900 n
Pendimethalin	40487421	4.00E-02 i					1500 n	150 n	54 n	41000 n	3100 n
Pentabromo-6-chloro cyclohexane	87843			2.30E-02 h			2.9 c	0.27 c	0.14 c	120 c	28 c
Pentabromodiphenyl ether	32534819	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Pentachlorobenzene	608935	8.00E-04 i				•••	4.9 n	2.9 n	1.1 n	820 n	63 n
Pentachloronitrobenzene	82688	3.00E-03 i		2.60E-01 h		•••	0.041 c	0.024 c	0.012 c	11 c	2.5 c
Pentachlorophenol	87865	3.00E-02 i		1.20E-01 i			0.56 c	0.052 c	0.026 c	24 c	5.3 c
Permethrin	52645531	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n
Phenmedipham	13684634	2.50E-01 i					9100 n	910 n	340 n	260000 n	20000 n
Phenol	108952	6.00E-01 i					22000 n	2200 n	810 n	610000 n	47000 n
m-Phenylenediamine	108452	6.00E-03 i					220 n	22 n	8.1 n	6100 n	470 n
p-Phenylenediamine	106503	1.90E-01 h					6900 n	690 n	260 n	190000 n	15000 n
Phenylmercuric acetate	62384	8.00E-05 i					2.9 n	0.29 n	0.11 n	82 n	6.3 n
2-Phenylphenol	90437			1.94E-03 h			35 c	3.2 c	1.6 c	1500 c	330 c
Phorate	298022	2.00E-04 h					7.3 n	0.73 n	0.27 n	200 n	16 n
Phosmet	732116	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Phosphine	7803512	3.00E-04 i	8.57E-06 h				11 n	0.031 n	0.41 n	310 n	23 n
Phosphorus (white)	7723140	2.00E-05 i					0.73 n	0.073 n	0.027 n	20 n	1.6 n
p-Phthalic acid	100210	1.00E+00 h					37000 n	3700 n	1400 n	1000000 n	78000 n
Phthalic anhydride	85449	2.00E+00 i	3.43E-01 h				73000 n	1300 n	2700 n	1000000 n	160000 n
Picloram	1918021	7.00E-02 i					2600 n	260 n	95 n	72000 n	5500 n
Pirimiphos-methyl	29232937	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
Polybrominated biphenyls		7.00E-06 h		8.90E+00 h			0.0076 c	0.0007 c	0.00035 c	0.32 c	0.072 c
Polychlorinated biphenyls (PCBs)	1336363			7.70E+00 i			0.0087 c	0.00081 c	0.00041 c	0.37 c	0.083 c
Aroclor 1016	12674112	7.00E-05 i					2.6 n	0.26 n	0.095 n	72 n	5.5 n
Polychlorinated terphenyls (PCTs)				4.50E+00 ●			0.015 c	0.0014 c	0.0007 c	0.64 c	0.14 c
Polynuclear aromatic hydrocarbons											
Acenaphthene	83329	6.00E-02 i					2200 n	220 n	81 n	61000 n	4700 n
Anthracene	120127	3.00E-01 i					11000 n	1100 n	410 n	310000 n	23000 n
Benzo[a]pyrene	50328			7.30E+00 i	6.10E+00 h		0.0092 c	0.001 c	0.00043 c	0.39 c	0.088 c
Benzo[b]fluoranthene	205992			7.30E-01 ●	6.10E-01 ●		0.092 c	0.01 c	0.0043 c	3.9 c	0.88 c
Benzo[k]fluoranthene	207089			7.30E-02 ●	6.10E-02 ●		0.92 c	0.1 c	0.043 c	39 c	8.8 c
Benz[a]anthracene	56553			7.30E-01 ●	6.10E-01 ●		0.092 c	0.01 c	0.0043 c	3.9 c	0.88 c

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Basis of RBC: c=carcinogenic effects n=noncarcinogenic effects.

Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg·d/mg	CPSi kg·d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
Chrysene	218019			7.30E-03 e	6.10E-03 e		9.2 c	1 c	0.43 c	390 c	88 c
Dibenz[ah]anthracene	53703			7.30E+00 e	6.10E+00 e		0.0092 c	0.001 c	0.00043 c	0.39 c	0.088 c
Fluoranthene	206440	4.00E-02 i					1500 n	150 n	54 n	41000 n	3100 n
Fluorene	86737	4.00E-02 i					1500 n	150 n	54 n	41000 n	3100 n
Indeno[1,2,3-cd]pyrene	193395			7.30E-01 e	6.10E-01 e		0.092 c	0.01 c	0.0043 c	3.9 c	0.88 c
Naphthalene	91203	4.00E-02 w					1500 n	150 n	54 n	41000 n	3100 n
Pyrene	129000	3.00E-02 i					1100 n	110 n	41 n	31000 n	2300 n
Prochloraz	67747095	9.00E-03 i		1.50E-01 i			0.45 c	0.042 c	0.021 c	19 c	4.3 c
Profluralin	26399360	6.00E-03 h					220 n	22 n	8.1 n	6100 n	470 n
Prometon	1610180	1.50E-02 i					550 n	55 n	20 n	15000 n	1200 n
Prometryn	7287196	4.00E-03 i					150 n	15 n	5.4 n	4100 n	310 n
Pronamide	23950585	7.50E-02 i					2700 n	270 n	100 n	77000 n	5900 n
Propachlor	1918167	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Propanil	709988	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Propargite	2312358	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Propargyl alcohol	107197	2.00E-03 i					73 n	7.3 n	2.7 n	2000 n	160 n
Propazine	139402	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Propham	122429	2.00E-02 i					730 n	73 n	27 n	20000 n	1600 n
Propiconazole	60207901	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Propylene glycol	57556	2.00E+01 h					730000 n	73000 n	27000 n	1000000 n	1000000 n
Propylene glycol, monoethyl ether	52125538	7.00E-01 h					26000 n	2600 n	950 n	720000 n	55000 n
Propylene glycol, monomethyl ether	107982	7.00E-01 h	5.71E-01 i				26000 n	2100 n	950 n	720000 n	55000 n
Propylene oxide	75569		8.57E-03 i	2.40E-01 i	1.29E-02 i		0.28 c	0.49 c	0.013 c	12 c	2.7 c
Pursuit	81335775	2.50E-01 i					9100 n	910 n	340 n	260000 n	20000 n
Pydrin	51630581	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Pyridine	110861	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Quinalphos	13593038	5.00E-04 i					18 n	1.8 n	0.68 n	510 n	39 n
Quinoline	91225			1.20E+01 h			0.0056 c	0.00052 c	0.00026 c	0.24 c	0.053 c
Resmethrin	10463868	3.00E-02 i					1100 n	110 n	41 n	31000 n	2300 n
Ronnel	299843	5.00E-02 h					1800 n	180 n	68 n	51000 n	3900 n
Rotenone	83794	4.00E-03 i					150 n	15 n	5.4 n	4100 n	310 n
Savey	78587050	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Selenious Acid	7783008	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Selenium	7782492	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Selenourea	630104	5.00E-03 h					180 n	18 n	6.8 n	5100 n	390 n
Sethoxydim	74051802	9.00E-02 i					3300 n	330 n	120 n	92000 n	7000 n
Silver and compounds	7440224	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Simazine	122349	5.00E-03 i		1.20E-01 h			0.56 c	0.052 c	0.026 c	24 c	5.3 c
Sodium azide	26628228	4.00E-03 i					150 n	15 n	5.4 n	4100 n	310 n
Sodium diethyldithiocarbamate	148185	3.00E-02 i		2.70E-01 h			0.25 c	0.023 c	0.012 c	11 c	2.4 c
Sodium fluoroacetate	62748	2.00E-05 i					0.73 n	0.073 n	0.027 n	20 n	1.6 n
Sodium metavanadate	13718268	1.00E-03 h					37 n	3.7 n	1.4 n	1000 n	78 n

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Contaminant	CAS	RfDo mg/kg/d	RfDi mg/kg/d	CPSo kg·d/mg	CPSi kg·d/mg	VOC	Tap water µg/L	Ambient air µg/m3	Fish mg/kg	Industrial soil mg/kg	Residential soil mg/kg
Strontium, stable	7440246	6.00E-01 i					22000 n	2200 n	810 n	610000 n	47000 n
Strychnine	57249	3.00E-04 i					11 n	1.1 n	0.41 n	310 n	23 n
Styrene	100425	2.00E-01 i	2.86E-01 i			***	1600 n	1000 n	270 n	200000 n	16000 n
Systhane	88671890	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
2,3,7,8-TCDD (dioxin)	1746016			1.56E+05 h	1.16E+05 h		4.30E-07 c	5.40E-08 c	2.00E-08 c	0.000018 c	4.10E-06 c
Tebuthiuron	34014181	7.00E-02 i					2600 n	260 n	95 n	72000 n	5500 n
Temephos	3383968	2.00E-02 h					730 n	73 n	27 n	20000 n	1600 n
Terbacil	5902512	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Terbufos	13071799	2.50E-05 h					0.91 n	0.091 n	0.034 n	26 n	2 n
Terbutryn	886500	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
1,2,4,5-Tetrachlorobenzene	95943	3.00E-04 i				***	1.8 n	1.1 n	0.41 n	310 n	23 n
1,1,1,2-Tetrachloroethane	630206	3.00E-02 i		2.60E-02 i	2.59E-02 i	***	0.41 c	0.24 c	0.12 c	110 c	25 c
1,1,2,2-Tetrachloroethane	79345			2.00E-01 i	2.03E-01 i	***	0.052 c	0.031 c	0.016 c	14 c	3.2 c
Tetrachloroethylene (PCE)	127184	1.00E-02 i		5.20E-02 e	2.03E-03 e	***	1.1 c	3.1 c	0.061 c	55 c	12 c
2,3,4,6-Tetrachlorophenol	58902	3.00E-02 i					1100 n	110 n	41 n	31000 n	2300 n
p,a,a,a-Tetrachlorotoluene	5216251			2.00E+01 h		***	0.00053 c	0.00031 c	0.00016 c	0.14 c	0.032 c
Tetrachlorovinphos	961115	3.00E-02 i		2.40E-02 h			2.8 c	0.26 c	0.13 c	120 c	27 c
Tetraethyldithiopyrophosphate	3689245	5.00E-04 i					18 n	1.8 n	0.68 n	510 n	39 n
Thallic oxide	1314325	7.00E-05 w					2.6 n	0.26 n	0.095 n	72 n	5.5 n
Thallium											
Thallium acetate	563688	9.00E-05 i					3.3 n	0.33 n	0.12 n	92 n	7 n
Thallium carbonate	6533739	8.00E-05 i					2.9 n	0.29 n	0.11 n	82 n	6.3 n
Thallium chloride	7791120	8.00E-05 i					2.9 n	0.29 n	0.11 n	82 n	6.3 n
Thallium nitrate	10102451	9.00E-05 i					3.3 n	0.33 n	0.12 n	92 n	7 n
Thallium selenite	12039520	9.00E-05 w					3.3 n	0.33 n	0.12 n	92 n	7 n
Thallium sulfate	7446186	8.00E-05 i					2.9 n	0.29 n	0.11 n	82 n	6.3 n
Thiobencarb	28249776	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
2-(Thiocyanomethylthio)-benzothiazole	21564170	3.00E-02 h					1100 n	110 n	41 n	31000 n	2300 n
Thiofanox	39196184	3.00E-04 h					11 n	1.1 n	0.41 n	310 n	23 n
Thiophanate-methyl	23564058	8.00E-02 i					2900 n	290 n	110 n	82000 n	6300 n
Thiram	137268	5.00E-03 i					180 n	18 n	6.8 n	5100 n	390 n
Tin and compounds		6.00E-01 h					22000 n	2200 n	810 n	610000 n	47000 n
Toluene	108883	2.00E-01 i	1.14E-01 w			***	750 n	420 n	270 n	200000 n	16000 n
Toluene-2,4-diamine	95807			3.20E+00 h			0.021 c	0.002 c	0.00099 c	0.89 c	0.2 c
Toluene-2,5-diamine	95705	6.00E-01 h					22000 n	2200 n	810 n	610000 n	47000 n
Toluene-2,6-diamine	823405	2.00E-01 h					7300 n	730 n	270 n	200000 n	16000 n
p-Toluidine	106490			1.90E-01 h			0.35 c	0.033 c	0.017 c	15 c	3.4 c
Toxaphene	8001352			1.10E+00 i	1.12E+00 i		0.061 c	0.0056 c	0.0029 c	2.6 c	0.58 c
Tralomethrin	66841256	7.50E-03 i					270 n	27 n	10 n	7700 n	590 n
Triallate	2303175	1.30E-02 i					470 n	47 n	18 n	13000 n	1000 n
Triasulfuron	82097505	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
1,2,4-Tribromobenzene	615543	5.00E-03 i				***	30 n	18 n	6.8 n	5100 n	390 n

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Tributyltin oxide (TBTO)	56359	3.00E-05 i					1.1 n	0.11 n	0.041 n	31 n	2.3 n
2,4,6-Trichloroaniline hydrochloride	33663502			2.90E-02 h			2.3 c	0.22 c	0.11 c	99 c	22 c
2,4,6-Trichloroaniline	634935			3.40E-02 h			2 c	0.18 c	0.093 c	84 c	19 c
1,2,4-Trichlorobenzene	120821	1.00E-02 i	5.71e-02 h			***	190 n	210 n	14 n	10000 n	780 n
1,1,1-Trichloroethane	71556	9.00E-02 w	2.86E-01 w			***	1300 n	1000 n	120 n	92000 n	7000 n
1,1,2-Trichloroethane	79005	4.00E-03 i		5.70E-02 i	5.60E-02 i	***	0.19 c	0.11 c	0.055 c	50 c	11 c
Trichloroethylene (TCE)	79016	6.00E-03 e		1.10E-02 w	6.00E-03 e	***	1.6 c	1 c	0.29 c	260 c	58 c
Trichlorofluoromethane	75694	3.00E-01 i	2.00E-01 e			***	1300 n	730 n	410 n	310000 n	23000 n
2,4,5-Trichlorophenol	95954	1.00E-01 i					3700 n	370 n	140 n	100000 n	7800 n
2,4,6-Trichlorophenol	88062			1.10E-02 i	1.09E-02 i		6.1 c	0.57 c	0.29 c	260 c	58 c
2,4,5-Trichlorophenoxyacetic acid	93765	1.00E-02 i					370 n	37 n	14 n	10000 n	780 n
2-(2,4,5-Trichlorophenoxy)propionic acid	93721	8.00E-03 i					290 n	29 n	11 n	8200 n	630 n
1,1,2-Trichloropropane	598776	5.00E-03 i				***	30 n	18 n	6.8 n	5100 n	390 n
1,2,3-Trichloropropane	96184	6.00E-03 i		7.00e+00 i		***	0.0015 c	0.00089 c	0.00045 c	0.41 c	0.091 c
1,2,3-Trichloropropene	96195	5.00E-03 h				***	30 n	18 n	6.8 n	5100 n	390 n
1,1,2-Trichloro-1,2,2- trifluoroethane	76131	3.00E+01 i	8.57E+00 h			***	59000 n	31000 n	41000 n	1000000 n	1000000 n
Tridiphane	58138082	3.00E-03 i					110 n	11 n	4.1 n	3100 n	230 n
Triethylamine	121448		2.00E-03 i				73 n	7.3 n			
Trifluralin	1582098	7.50E-03 i		7.70E-03 i			8.7 c	0.81 c	0.41 c	370 c	83 c
1,2,4-Trimethylbenzene	95636	5.00e-04 e				***	3 n	1.8 n	0.68 n	510 n	39 n
1,3,5-Trimethylbenzene	108678	4.00e-04 e				***	2.4 n	1.5 n	0.54 n	410 n	31 n
Trimethyl phosphate	512561			3.70E-02 h			1.8 c	0.17 c	0.085 c	77 c	17 c
1,3,5-Trinitrobenzene	99354	5.00E-05 i					1.8 n	0.18 n	0.068 n	51 n	3.9 n
Trinitrophenylmethylnitramine	479458	1.00E-02 h					370 n	37 n	14 n	10000 n	780 n
2,4,6-Trinitrotoluene	118967	5.00E-04 i		3.00E-02 i			2.2 c	0.21 c	0.11 c	95 c	21 c
Uranium (soluble salts)	7440611	3.00E-03 i					110 n	11 n	4.1 n	3100 n	230 n
Vanadium	7440622	7.00E-03 h					260 n	26 n	9.5 n	7200 n	550 n
Vanadium pentoxide	1314621	9.00E-03 i					330 n	33 n	12 n	9200 n	700 n
Vanadium sulfate	36907423	2.00E-02 h					730 n	73 n	27 n	20000 n	1600 n
Vernam	1929777	1.00E-03 i					37 n	3.7 n	1.4 n	1000 n	78 n
Vinclozolin	50471448	2.50E-02 i					910 n	91 n	34 n	26000 n	2000 n
Vinyl acetate	108054	1.00E+00 h	5.71E-02 i				37000 n	210 n	1400 n	1000000 n	78000 n
Vinyl bromide	593602		8.57E-04 i			***	5.2 n	3.1 n			
Vinyl chloride	75014			1.90E+00 h	3.00E-01 h	***	0.019 c	0.021 c	0.0017 c	1.5 c	0.34 c
Warfarin	81812	3.00E-04 i					11 n	1.1 n	0.41 n	310 n	23 n
m-Xylene	108323	2.00E+00 h	2.00E-01 w			***	1400 n	730 n	2700 n	1000000 n	160000 n
o-Xylene	95476	2.00E+00 h	2.00E-01 w			***	1400 n	730 n	2700 n	1000000 n	160000 n
p-Xylene	106423		8.57E-02 w			***	520 n	310 n			
Xylene (mixed)	1330207	2.00E+00 i				***	12000 n	7300 n	2700 n	1000000 n	160000 n
Zinc	7440666	3.00E-01 i					11000 n	1100 n	410 n	310000 n	23000 n
Zinc phosphide	1314847	3.00E-04 i					11 n	1.1 n	0.41 n	310 n	23 n
Zineb	12122677	5.00E-02 i					1800 n	180 n	68 n	51000 n	3900 n

J

APPENDIX J

SUDBURY BACKGROUND DATA

APPENDIX J

SUDBURY ANNEX BACKGROUND DATA

J.1 INTRODUCTION

Background concentration ranges for inorganic analytes in sediment, soil, and surface water were determined from designated background samples collected on or near the Sudbury Annex. The background sediment and soil databases were compared with regional data from the peer-reviewed scientific literature to assess their validity for use as background.

Appendix J is divided into three sections based on matrix. The sections are:

- Background Concentrations of Inorganic Analytes in Sediment;
- Background Concentrations of Inorganic Analytes in Soil;
- Background Concentrations of Inorganic Analytes in Surface Water.

Tables J-1 through J-4 contain on-site, local, and regional background analyte concentration ranges for sediment, soil, and surface water. Tables J-5 through J-9 provide a complete list of analytical results for background samples collected at the Annex and off-facility (Ministers Pond).

J.2 BACKGROUND CONCENTRATIONS OF INORGANIC ANALYTES IN SEDIMENT

E & E collected nine background sediment samples in September and November 1993. Three samples were taken from Taylor Brook (sites E3–BCK–D01, E3–BCK–D04, and E3–BCK–D08) and six from Ministers Pond (sites E3–OFF–D01 through E3–OFF–D06). Because several PAH compounds were measured in sediment from site E3–BCK–D01, the site was considered not to be representative of background conditions and was not used when determining background ranges. Because only two stream sediment samples remained, no method for the removal of outliers (statistical extremes) could be applied to the stream data. For inorganic analytes present in pond sediment above the certified reporting level (CRL), outliers were identified by the method of Dixon as described by Sokal and Rohlf (1981); none were found.

Example Calculation (Dixon's Test)

Dixon's test is carried out as follows as per lead. The variates are ordered from high to low so the first variate, Y_1, is the suspected outlier. Dixon's test statistic, r, is calculated as

$$r = (Y_2\text{-}Y_1)/(Y_{n\text{-}1}\text{-}Y_1)$$

This value is compared to the critical value of r, r_{crit}. For n = 8 at the 95 percent confidence level r_{crit} = 0.554 (Sokal and Rohlf 1981). If r is greater than r_{crit}, the variate is an outlier. In this example, 0.779 is greater than 0.554 so 39 is an outlier.

To determine if the second highest lead value is an outlier, Dixon's test can be applied a second time for the remaining seven variates. For seven variates r is calculated as

$$r = (Y_2\text{-}Y_1 1)/(Y_n\text{-}Y_1)$$

where Y_n is the last variate in the array. For this example,

$$r = (12.3\text{-}12.5)/(3.5\text{-}12.5) = 0.022$$

For n = 7 at the 95 percent confidence level r_{crit} = 0.507. Because r is less than r_{crit}, 12.5 is not an outlier (Sokal and Rohlf 1981).

Table J-1 lists concentration ranges for inorganic analytes for the designated background samples, excluding outliers. Separate ranges are presented for stream and pond sediment because these sediment types differ in grain-size distribution and organic-matter content, two factors that affect the ability of sediments to retain trace metals and major ions (Forsther and Wittman 1979). Fine-grained, organic-rich sediments, such as those from the center of a lake or pond, typically have higher levels of metals and major ions than coarse-grained organic-poor sediments, such as those from a high-energy stream. Inorganic analyte levels in site samples were compared with the maximum of the background range; exceedences were considered site-related contamination.

For comparison, Table J-1 also includes concentration ranges for inorganic analytes in surficial, mid-basin, sediment from remote New England lakes, and normal levels for Massachusetts lakes and ponds. For nearly all inorganic analytes, the maximum levels in stream and pond sediment from the Annex lie within or below the range for the New England and Massachusetts lakes. This suggests that comparing inorganic analyte levels in site samples to the maximum of the Annex background database was a sensitive method for identifying site-related contamination.

Table J-2 lists the names, locations, and inorganic analyte data for the New England lakes used to develop the concentration ranges reported in Table J-1. None of the lakes were affected by point sources of metal pollution. Atmospheric deposition was the only source of metals to the lakes and their watersheds. None of the lakes were located near major cities. "Normal" levels of eleven metals in sediment from Massachusetts lakes and ponds are from Rojko's proposed classification scheme (Rojko 1990).

J.3 BACKGROUND CONCENTRATIONS OF INORGANIC ANALYTES IN SOIL

Ten background soil samples for inorganic analytes were collected in September 1993. Outliers were identified by the method of Dixon as described by Sokal and Rohlf (1981). A single outlier for arsenic was found. Values listed as less than the CRL were converted to one-half the CRL for the calculations.

Table J-3 lists concentration ranges for inorganic analytes for the Annex background soil database, excluding outliers. Inorganic analyte levels in site samples were compared with the maximum of the background range; exceedences were considered to be a result of site-related contamination.

For comparison, Table J-3 also lists concentration ranges for inorganic analytes in uncontaminated soils of the eastern United States. For all analytes, the maximum concentration in the Annex background database lies within the range for the eastern United States, usually toward the low end of the range. This suggests that comparing inorganic analyte levels in site samples to the maximum of the Annex background database was a sensitive method for identifying site-related contamination.

J.4 BACKGROUND CONCENTRATIONS OF INORGANIC ANALYTES IN SURFACE WATER

E & E collected nine background surface-water samples for inorganic analytes in September and November 1993. Three samples were taken from Taylor Brook (sites E3-BCK-D01, E3-BCK-D04, and E3-BCK-D08) and six from Minister's Pond (sites E3-OFF-D01 through E3-OFF-D06). The samples were collected at the same time and locations as the background sediment samples. Because several PAH compounds were measured in sediment from site E3-BCK-D01, the site was considered not to be representative of background conditions and was not used when determining background concentration ranges for surface water. Because only two stream water samples remained, no formal test for outliers could be applied to the stream data. For analytes present in pond water above the CRL, Dixon's test (Sokal and Rohlf 1981) was used to identify outliers; none were found.

Table J-4 lists concentration ranges for inorganic analytes for the Annex background surface-water database. Separate ranges are presented for stream and pond water. Analyte levels in site samples were compared with the maximum of the background range; exceedences were considered to be a result of site-related contamination.

J.5 REFERENCES

Davis, A.O. and J.N. Galloway, 1981, "Atmospheric lead and zinc deposition into lakes of the Eastern United States," pp. 401-408 In: S.J. Eisenreich (Ed.), *Atmospheric Pollutants in Natural Waters*, Ann Arbor Science Publishers, Ann Arbor, Michigan.

Forsther, U. and G.T.W. Wittman, 1979, *Metal Pollution in the Aquatic Environments*, Springer-Verlag, Berlin, Germany.

Galloway, J.N. and G.E. Likens, 1979, *Atmospheric enhancement of metal deposition in Adirondack lake sediments*, Limnology and Oceanography 24:427-433.

Heit, M., Y. Tan, C. Klusek and J.C. Burke, 1981, *Anthropogenic trace elements and polycyclic aromatic hydrocarbon levels in sediment cores from two lakes in the Adirondack acid lake region*, Water, Air, and Soil Pollution 15:441-464.

Kahl, J.S., S.A. Norton and J.S. Williams, 1984, "Chronology, magnitude, and paleolimnological record of changing metal fluxes related to atmospheric deposition of acids and metals in New England," pp. 23-35 In: O.P. Bricker (Ed.) *Geological Aspects of Acid Deposition*, Butterworth Publishers, Boston, Massachusetts.

Norton, S.A., C.T. Hess and R.B. Davis, 1981, "Rates of accumulation of heavy metals in pre- and post-European sediments in New England lakes," pp. 409-421 In: S.J. Eisenreich (Ed.) *Atmospheric Pollutants in Natural Waters*, Ann Arbor Science Publishers, Ann Arbor, Michigan.

Rojko, A, 1990, *Heavy Metals in Sediments from Massachusetts Lakes and Ponds*, Master's Report, Northeastern University, MA.

Shacklette, H.T. and J.G. Boerngen, 1984, *Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States*, U.S. Geological Survey Professional Paper 1270, U.S. Government Printing Office, Washington, D.C.

Sokal, R.R. and F.J. Rohlf, 1981, *Biometry*, 2nd Edition, W.H. Freeman and Company, New York, NY.

Table J-1

CONCENTRATION RANGES FOR INORGANIC ANALYTES IN BACKGROUND SEDIMENTS FROM SUDBURY ANNEX AND OTHER NEW ENGLAND LOCATIONS

Analyte	Background STREAM Sediment from Sudbury[a] (mg/kg)	Background POND Sediment from Sudbury[b] (mg/kg)	Mid-Basin Bottom Sediment From Remote New England Lakes[c] (mg/kg)	"Normal" Levels in MA Lakes and Ponds[f] (mg/kg)
Aluminum	4,250 - 5,020	2,050 - 5,740	4,610 - 58,300	NR
Antimony	0.5[d]	0.5[d]	2.5 - 3.0	NR
Arsenic	1.22 - 2.03	2.10 - 9.56	5.3 - 13	<25
Barium	9.23 - 23.9	19.2 - 55.3	282	NR
Beryllium	0.093 - 0.180	0.5[d]	5.1 - 7.8	NR
Cadmium	0.5[d]	<0.5 - 2.06	1.5 - 3.0	<5
Calcium	357 - 562	1,640 - 4,550	1,250 - 28,400	NR
Chromium	6.95 - 9.66	5.2 - 12.8	7.6 - 30	<30
Cobalt	3.45 - 3.74	3.3 - 11.4	5.43	NR
Copper	3.79 - 6.33	4.47 - 10.9	8.7 - 20	<70
Iron	6,410 - 7,590	4,120 - 16,300	6,470 - 71,800	<30,000
Lead	4.1 - 4.48	11.5 - 49.4	53 - 310	<200
Magnesium	1,240 - 2,140	401 - 1,480	940 - 9,800	NR
Manganese	58.9 - 70.5	22.4 - 74.1	45 - 4,930	<350
Mercury			0.38 - 0.69	<0.35
Nickel	5.75 - 5.92	11.7 - 23.2	6.4 - 11	<35
Potassium	448 - 1520	<200 - 900	1,570 - 15,000	NR
Selenium	0.2[d]	0.2[d]	1.6 - 4.6	NR
Silver		<0.2 - 0.879	0.4 - 0.64	NR
Sodium	200[d]	<700 - 778	930 - 6,200	NR
Thallium	<0.5 - 0.195	0.5[d]	5.8 - 10	NR
Vanadium	9.23 - 17.0	5.61 - 21.8	40 - 142	<60
Zinc	20.8[e]	22.8 - 55.3	35 - 400	<250

Legend: NR = Not Reported.

[a]n = 2.
[b]Maximum of range determined after outlier removal (see text).
[c]See Table J-2.
[d]Certified reporting level (CRL).
[e]n = 1.
[f]Rojko (1990).

Source: Ecology and Environment, Inc. 1994.

Table J-2

METAL CONCENTATIONS (mg/kg) IN SURFICIAL, MID-BASIN, BOTTOM SEDIMENT FROM REMOTE NEW ENGLAND LAKES

Lake Name and Location	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead
Mountain Lake Virginia (1)	NR*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	155-170
Woodhull Lake New York*** (2)	43,000	2.5-3.0	10.4	282	NR	3.0	28,400	25-30	5.43	18-20	27,600	160-200
Dream Lake @ NH (4)	15,900	NR	NR	NR	NR	NR	3,000	NR	NR	12-19	4,900	~55
Unnamed Pond @ Maine (4)	7,910	NR	NR	NR	NR	NR	1,250	NR	NR	NR	6,470	80-100
Sagamore Lake NY*** (3)	22,000	NR	5.3-6.5	NR	5.1-7.8	1.5-2.1	NR	8-11	NR	8.7-9.9	NR	53
Woods Lakes NY*** (3)	10,000-27,000	NR	13	NR	5.7-5.8	2.6-2.8	NR	7.6	NR	15	NR	138
Little Long Lake @ Maine (4)	30,000	NR	NR	NR	NR	NR	1,580	NR	NR	13-16	23,500	140
Granite Lake @ NH (5)	58,300	NR	NR	NR	NR	NR	2,940	NR	NR	NR	71,800	310
Klondike Pond @ Maine (5)	4,610	NR	NR	NR	NR	NR	3,020	NR	NR	NR	21,900	~72
Mountain Pond @ Maine (5)	30,300	NR	NR	NR	NR	NR	1,930	NR	NR	NR	21,800	125-150
Speck Pond @ Maine (5)	24,300	NR	NR	NR	NR	NR	2,200	NR	NR	NR	11,500	~123
Overall Range:	4,610-58,300	2.5-3.0	5.3-13	282	5.1-7.8	1.5-3.0	1,250-28,400	7.6-30	5.43	8.7-20	4,900-71,800	53-310

References at end of table.

11:UC6101/RC1287_V4-11/02/94-D1

Table J-2 (continued)

METAL CONCENTATIONS (mg/kg) IN SURFICIAL, MID-BASIN, BOTTOM SEDIMENT FROM REMOTE NEW ENGLAND LAKES

Lake Name and Location	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
Mountain Lake Virginia (1)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	160-170
Woodhull Lake New York*** (2)	9,800	292	NR	10.2	15,000	NR	0.5-0.55	6,200	NR	40-55	150-400
Dream Lake @, NH (4)	1,100	100	NR	NR	2,800	NR	NR	1,780	NR	NR	72-96
Unnamed Pond @ Maine (4)	980	45	NR	NR	5,700	NR	NR	1,400	NR	NR	35-160
Sagamore Lake NY*** (3)	NR	NR	0.38-0.69	6.4-9.0	NR	1.6-1.9	0.4	NR	10	105-142	139-160
Woods Lakes NY*** (3)	NR	NR	0.46	11	NR	4.6	0.56-0.64	NR	5.8-6.9	114-126	345
Little Long Lake @ Maine (4)	2,100	98	NR	NR	1,570	NR	NR	930	NR	NR	100-160
Granite Lake @ NH (5)	6,200	1010	NR	NR	10,600	NR	NR	2,630	NR	NR	280
Klondike Pond @ Maine (5)	1,290	4930	NR	NR	12,800	NR	NR	4,870	NR	NR	215
Mountain Pond @ Maine (5)	1,780	3300	NR	NR	3,700	NR	NR	1,270	NR	NR	135-175
Speck Pond @ Maine (5)	940	890	NR	NR	1,700	NR	NR	1,520	NR	NR	62-164
Overall Range:	940-9,800	45-4,930	0.38-0.69	6.4-11	1,570-15,000	1.6-4.6	0.4-0.64	930-6,200	5.8-10	40-142	35-400

*NR = not reported.
**Lakes included in this table have no point source of metal polluton in their watersheds.
***Adirondack Mountain Region.
@ Values determined form figures presented by the cited author(s).

(1) Davis and Galloway 1981.
(2) Galloway and Likens 1979.
(3) Heit *et al.* 1981.
(4) Kahl *et al.* 1984.
(5) Norton *et al.* 1981.

Source: Ecology and Environment, Inc. 1994.

Table J-3

CONCENTRATION RANGES FOR INORGANIC ANALYTES IN BACKGROUND SOIL SAMPLES FROM THE ANNEX

Analyte	Range for Sudbury Background Soil Samples (mg/kg)[a]	Range for Soil in Eastern U.S. (mg/kg)[b]
Aluminum	1,980 - 10,400	7,000 - >100,000
Antimony	0.5[c]	<1 - 8.8
Arsenic	5.44 - 10	<0.1 - 73
Barium	6.66 - 25.1	10 - 1,500
Beryllium	0.13 - 0.446	<1 - 7
Cadmium	0.5[c]	NR*
Calcium	98.9 - 1,170	100 - 280,000
Chromium	4.06 - 14.2	1 - 1,000
Cobalt	1.9 - 6.1	<0.3 - 70
Copper	4.0 - 10.7	<1 - 700
Iron	4600 - 12,300	100 - >100,000
Lead	8.0 - 150	<10 - 300
Magnesium	132 - 2,310	50 - 50,000
Manganese	9.0 - 95.8	<2 - 7,000
Mercury	<0.10 - 0.318	0.01 - 3.4
Nickel	3.5 - 10.7	<5 - 700
Potassium	295 - 617	50 - 37,000
Selenium	<0.2 - 0.571	<0.1 - 3.9
Silver		-
Sodium	200[c]	<500 - 50,000
Vanadium	14.5 - 33.0	<7 - 300
Thallium		
Zinc	12.3 - 44.6	<5 - 2,900

*NR = not reported.

[a]Upper limit of range in background database determined after outlier removal (see text).
[b]Shacklette and Boerngen (1984).
[c]Certified reporting level (CRL).

Source: Ecology and Environment, Inc. 1994.

Table J-4

CONCENTRATION RANGES FOR ANALYTES IN BACKGROUND SURFACE-WATER SAMPLES FROM THE SUDBURY ANNEX, MASSACHUSETTS

Analyte	Range in Background STREAM Water (ug/L)[a]	Range in Background POND Water (ug/L)[b]
Aluminum	222 - 400	48.1 - 69.2
Antimony	5.0[c]	5.0[c]
Arsenic	1.96 - 3.15	2.0[c]
Barium	9.04 - 10.4	11.9 - 14.0
Beryllium	5.0[c]	5.0[c]
Cadmium	5.0[c]	5.0[c]
Calcium	7,690 - 8,520	7,910 - 8,730
Chromium	2.90 - 3.16	10.0
Cobalt	3.08 - 4.79	2.30 - 2.32[d]
Copper	10.0[c]	10.0[c]
Iron	2,770 - 4,810	954 - 1,110
Lead	3.82 - 10.3	0.89 - 3.02
Magnesium	1,760 - 1,890	2,080 - 2,250
Manganese	120 - 156	20.0 - 26.6
Mercury		
Nickel	10.0[c]	<10 - 11.3
Potassium	1,640 - 2,060	3,220 - 3,640
Selenium	2.0[c]	2.0[c]
Silver		
Sodium	5,760 - 14,000	16,500 - 18,000
Thallium		
Vanadium	4.08 - 4.72	10.0[c]
Zinc	11.5 - 13.3	53.6 - 67.8

[a]n = 2.
[b]Maximum of range determined after outlier removal (see text).
[c]Certified reporting level (CRL).
[d]n = 2.

Source: Ecology and Environment, Inc. 1994.

Date: 03/21/95
File Type: CSO
Site Type: AREA

Table: J-5
Chemical Summary Report For Background Surficial Soils

Units: UGG

	Site ID	E3-BCK-S01	E3-BCK-S01	E3-BCK-S02	E3-BCK-S03	E3-BCK-S04	E3-BCK-S05
	Field Sample ID	SXBCK011	SXBCK011	SXBCK021	SXBCK031	SXBCK041	SXBCK051
	Sample Date	09/20/93	09/21/93	09/21/93	09/21/93	09/21/93	09/21/93
Test	Parameter .						
TAL METAL	Aluminum		8010	9170	9640	10400	5090
	Arsenic		7.29 J	6.25 J	17.0 J	8.90 J	5.91 J
	Barium		20.7	18.4	19.9	25.1	7.04
	Beryllium		0.247 J	0.288 J	0.350 J	0.405 J@	0.130 J
	Calcium		238 J	313 J	789	247 J	145 J
	Chromium		11.1	12.4	12.1	10.9	5.85
	Cobalt		4.04	4.67	3.96	4.29	2.07
	Copper		8.78	8.37	10.7	8.99	4.06
	Iron		11200	12300	9320	12000	6370
	Lead		39.0	53.0	110	29.0	16.0
	Magnesium		930	1220	1030	1110	490 J
	Manganese		35.4	47.0	71.1	73.3	25.8
	Mercury		< 0.100	0.165	0.106 J	< 0.100	< 0.100
	Nickel		6.59	7.39	8.25	7.33	4.00
	Potassium		587	617	481 K	347 K	218 BJ
	Selenium		0.571 J	0.476 J	0.350 J	0.422 J	0.249 J
	Vanadium		33.0	32.3	30.9	23.3	14.5
	Zinc		23.2	28.3	36.1	21.0	12.3
TCL Pest	Dieldrin	0.005 BC		0.005 C	0.008 U	0.003 U	0.004 C
	Endosulfan Sulfate	0.003 BU		0.008 U	0.008 U	0.008 C	0.003 C
	Endosulfan,B	0.001 BJC		0.002 JU	0.004 U	0.005 U	0.002 JU
	Endrin	0.002 BJU		0.004 C	0.005 U	0.004 C	< 0.002
	Endrin Aldehyde	< 0.002		0.006 BC	< 0.002	0.011 KC	0.007 BC
	Heptachlor Epoxide	< 0.002		< 0.002	0.002 BJC	0.001 BJU	0.001 BJU
	Lindane	0.002 BJU		0.004 U	0.002 JU	0.002 U	0.001 JC
	P,P-DDD	0.013 C		0.006 KU	0.063 C	0.008 KU	< 0.002
	P,P-DDE	0.026 KC		0.008 CK	0.095 C	0.008 CK	0.001 BJC

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

B= Attributable to field or laboratory contamination. J= Estimated value. L= Result bias low. @= Exceeds human health screening value.
C= Confirmed on second column. U= Unconfirmed. K= Result bias high. R= Result rejected.

Date: 03/21/95
File Type: CSO
Site Type: AREA

Table: J-5

Chemical Summary Report For Background Surficial Soils

Units: UGG

	Site ID	E3-BCK-S01	E3-BCK-S01	E3-BCK-S02	E3-BCK-S03	E3-BCK-S04	E3-BCK-S05
	Field Sample ID	SXBCK011	SXBCK011	SXBCK021	SXBCK031	SXBCK041	SXBCK051
	Sample Date	09/20/93	09/21/93	09/21/93	09/21/93	09/21/93	09/21/93
Test	Parameter .						
TCL Pest	P,P-DDT	0.060 C		0.027 C	0.230 C	0.023 C	0.006 C
	alpha-BHC	< 0.002		0.004 C	0.003 C	0.004 U	0.003 U
	alpha-Chlordane	< 0.002		0.001 JU	0.001 JU	< 0.002	0.000 JU
	beta-BHC	< 0.002		< 0.002	< 0.002	0.004 U	< 0.002
	delta-BHC	< 0.002		< 0.002	0.001 BJU	0.003 KU	0.001 BJU
	gamma-Chlordane	< 0.002		0.001 JU	0.002 JC	0.002 JU	0.002 JU

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

B= Attributable to field or laboratory contamination.
C= Confirmed on second column. U= Unconfirmed.
J= Estimated value. L= Result bias low. @= Exceeds human health screening value.
K= Result bias high. R= Result rejected.

Date: 03/21/95
File Type: CSO
Site Type: AREA

Table: J-5

Chemical Summary Report For Background Surficial Soils

Units: UGG

Test	Parameter	E3-BCK-S06	E3-BCK-S07	E3-BCK-S08	E3-BCK-S09	E3-BCK-S10	
	Field Sample ID	SXBCK061	SXBCK071	SXBCK081	SXBCK091	SXBCK101	
	Sample Date	09/22/93	09/23/93	09/23/93	09/23/93	09/23/93	
TAL METAL	Aluminum	7810	1980	9870	3770	5640	
	Arsenic	5.44 J	7.46 J	10.0 J	9.17 J	9.95 J	
	Barium	18.3	23.2	15.8	6.66	10.2	
	Beryllium	0.271 J	0.214 JL	0.446 JL@	0.203 JL	0.287 JL	
	Calcium	462 J	1170	98.9 J	< 500	481 J	
	Chromium	14.2	4.06	11.1	6.25	9.92	
	Cobalt	6.13	1.91	4.44	2.66	3.10	
	Copper	8.93	10.5	7.65	8.04	5.33	
	Iron	12000	4600	8760	7740	7310	
	Lead	8.00	150	26.0	52.0	57.0	
	Magnesium	2310	132 J	962	194 J	796	
	Manganese	95.8	69.2	87.7	9.01	36.7	
	Mercury	< 0.100	0.318	0.100 J	< 0.100	0.118 J	
	Nickel	10.7	6.70	6.83	3.57	6.47	
	Potassium	581 K	262 BJ	291 B	219 BJ	295 K	
	Selenium	< 0.200 J	0.553 J	0.213 J	0.480 J	0.329 J	
	Vanadium	18.5	32.8	16.7	28.3	28.3	
	Zinc	20.0	44.6	27.7	28.8	20.4	
TCL Pest	Dieldrin	0.003 BU	0.023 C	0.002 BJU	< 0.002	0.008 KC	
	Endosulfan Sulfate	0.005 KU	0.003 BC	0.006 KU	0.001 BJU	0.003 BU	
	Endosulfan,B	0.002 U	0.004 C	0.002 JU	< 0.002	< 0.002	
	Endrin	0.002 BC	0.008 C	0.002 BJC	< 0.002	< 0.002	
	Endrin Aldehyde	0.009 C	< 0.002	< 0.002	0.001 JC	0.002 JU	
	Heptachlor Epoxide	0.001 BJU	0.006 KC	< 0.002	< 0.002	0.001 JC	
	Lindane	0.003 BU	0.004 BU	0.003 BU	0.002 BJC	0.003 BJC	
	P,P-DDD	< 0.002	0.032 U	0.004 BU	0.005 U	0.011 C	
	P,P-DDE	0.002 BJC	0.139 C	0.004 BC	0.020 C	0.029 C	

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

B= Attributable to field or laboratory contamination. J= Estimated value. L= Result bias low. @= Exceeds human health screening value.
C= Confirmed on second column. U= Unconfirmed. K= Result bias high. R= Result rejected.

Date: 03/21/95
File Type: CSO
Site Type: AREA

Table: J-5
Chemical Summary Report For Background Surficial Soils

Units: UGG

	Site ID	E3-BCK-S06	E3-BCK-S07	E3-BCK-S08	E3-BCK-S09	E3-BCK-S10
	Field Sample ID	SXBCK061	SXBCK071	SXBCK081	SXBCK091	SXBCK101
	Sample Date	09/22/93	09/23/93	09/23/93	09/23/93	09/23/93
Test	Parameter .					
TCL Pest	P,P-DDT	0.005 U	0.139 C	0.007 U	0.051 C	0.069 C
	alpha-BHC	0.003 BC	0.005 BC	0.002 BJC	0.001 BJC	0.001 BJC
	alpha-Chlordane	0.001 JU	0.004 C	0.001 JU	0.001 BJC	0.001 BJC
	beta-BHC	0.002 JC	< 0.002	0.002 JC	< 0.002	< 0.002
	delta-BHC	0.010 CK	0.001 BJC	< 0.002	< 0.002	< 0.002
	gamma-Chlordane	0.002 BJU	0.005 KC	< 0.002	< 0.002	< 0.002

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

B= Attributable to field or laboratory contamination.
C= Confirmed on second column. U= Unconfirmed.
J= Estimated value. L= Result bias low. @= Exceeds human health screening value.
K= Result bias high. R= Result rejected.

Date: 03/21/95 File Type: CSE Site Type: POND	Table: J-6 Chemical Summary Report For Sediments (Ministers Pond) Background Pond Units: UGG	Page 1 of 1 Part 1 of 1

	Site ID	E3-OFF-D01	E3-OFF-D02	E3-OFF-D03	E3-OFF-D04	E3-OFF-D05	E3-OFF-D06
	Field Sample ID	DXOFA011	DXOFA021	DXOFA031	DXOFA041	DXOFA051	DXOFA061
	Sample Date	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93
Test	Parameter .						
TAL METAL	Aluminum	5740	3850	4720	2320	2050	4330
	Arsenic	3.33	3.46	3.85	2.10	3.40	9.56 #
	Barium	43.4	43.3	44.2	19.2	29.2	55.3
	Cadmium	0.669 BJ#	2.06 KJ#	0.863 BJ#	< 0.500	< 0.500	0.924 BJ#
	Calcium	3310	3550	3630	1640	2690	4550
	Chromium	12.8	9.81	10.6	5.20 J	5.33 J	11.3 J
	Cobalt	4.50	5.82	6.11	3.30	3.65 J	11.4
	Copper	8.10	7.70	9.00	4.56	4.47	10.9
	Iron	6240	6810	6790	4120	5720	16300
	Lead	23.7	34.7 #	37.5 #	11.5	17.2	49.4 #
	Magnesium	1480 J	948 J	1110 J	485 J	401 J	956 J
	Manganese	57.9	43.6	47.8	22.4	32.4	74.1
	Nickel	11.7	14.0	14.4	12.7	13.1	23.2 #
	Potassium	545 KJ	< 200	900 J	491 KJ	198 BJ	< 200
	Silver	< 0.200	< 0.200	< 0.200	0.605 #	0.879 #	< 0.200
	Sodium	492 J	531 J	239 KJ	< 200	278 J	778 J
	Vanadium	12.6	10.8	12.6	5.61 J	8.52	21.8
	Zinc	32.5	44.3	41.8	22.8	23.9	55.3
TCL Pest	P,P-DDD	0.390 C#	0.063 C#	0.110 C#	0.022 JC#	0.004 JC#	0.060 JC#
	P,P-DDE	0.074 C#	< 0.010	0.037 JC#	< 0.010	< 0.002	< 0.010
TOC	Total Organic Carbon	336000	433000	439000	488000	437000	577000

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

B= Attributable to field or laboratory contamination. J= Estimated value. L= Result bias low.
C= Confirmed on second column. U= Unconfirmed. K= Result bias high. R= Result rejected. #= Exceeds ecological screening value.

Date: 03/21/95
File Type: CSW
Site Type: POND

Table: J-7
Chemical Summary Report For Surface Waters (Ministers Pond)
Background Pond
Units: UGL

	Site ID	E3-OFF-D01	E3-OFF-D02	E3-OFF-D03	E3-OFF-D04	E3-OFF-D05	E3-OFF-D06
	Field Sample ID	WXOFA011	WXOFA021	WXOFA031	WXOFA041	WXOFA051	WXOFA061
	Sample Date	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93	11/09/93
Test	Parameter .						
TAL METAL	Aluminum	61.1	58.3	69.2	53.9	61.0	48.1
	Antimony	< 5.00	< 5.00	1.25 J	< 5.00	< 5.00	< 5.00
	Barium	12.2	11.9	12.4	14.0	13.4	11.9
	Calcium	8510	8180	8280	8730	8580	7910
	Cobalt	< 10.0	2.32 J	< 10.0	2.30 J	< 10.0	< 10.0
	Iron	992	954	966	1030 #	1110 #	1020 #
	Lead	1.08 J	0.910 J	0.890 J	1.39 J	3.02 J	< 5.00
	Magnesium	2200	2120	2140	2250	2220	2080
	Manganese	26.6	25.1	26.2	26.3	26.5	20.0
	Nickel	11.3	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
	Potassium	3450	3220	3240	3420	3640	3200 K
	Sodium	17500	16500	16800	18000	18000	17800
	Zinc	67.8	53.6 K	60.9 K	22.6 B	30.4 K	9.33 BJ

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

B= Attributable to field or laboratory contamination.
C= Confirmed on second column. U= Unconfirmed.
J= Estimated value. L= Result bias low. @= Exceeds human health screening value.
K= Result bias high. R= Result rejected. #= Exceeds ecological screening value.

Date: 03/21/95
File Type: CSE
Site Type: POND

Table: J-8

Chemical Summary Report For Background Sediments

Units: UGG

	Site ID	E3-BCK-D01	E3-BCK-D04	E3-BCK-D08			
	Field Sample ID	DXBCK011	DXBCK041	DXBCK081			
	Sample Date	09/15/93	09/17/93	09/21/93			
Test	Parameter .						
TAL METAL	Aluminum	3290	4250	5020			
	Arsenic	2.93	2.03	1.22			
	Barium	12.8	9.23	23.9			
	Beryllium	0.153 JL	0.180 JL	0.093 J			
	Calcium	449 J	357 J	562 J			
	Chromium	9.21	6.95	9.66			
	Cobalt	3.76	3.45	3.74			
	Copper	5.89 L	6.33 L	3.79			
	Iron	6860	6410	7590			
	Lead	36.0 J #	4.48 J	4.10 J			
	Magnesium	98700	124000	2140			
	Manganese	117	58.9	70.5			
	Nickel	7.98	5.92	5.75			
	Potassium	587	448 K	1520			
	Thallium	< 0.500	< 0.500	0.195 J			
	Vanadium	8.39	9.23	17.0			
	Zinc	31.4 J	16.9 J	20.8			
TCL BNA	Anthracene	0.350 J#	< 0.330 R	< 0.660			
	Benzo(a)anthracene	1.50 #	< 0.330 R	< 0.660			
	Benzo(a)pyrene	1.30 #	< 0.330 R	< 0.660			
	Benzo(b)fluoranthene	2.00	< 0.330 R	< 0.660			
	Benzo(ghi)perylene	0.550	< 0.330 R	< 0.660			
	Benzo(k)fluoranthene	0.770	< 0.330 R	< 0.660			
	Chrysene	1.50 #	< 0.330 R	< 0.660			
	Dibenzo(a,h)anthracene	0.170 J	< 0.330 R	< 0.660			
	Fluoranthene	3.80 #	< 0.330 R	< 0.660			
	Fluorene	0.130 J	< 0.330 R	< 0.660			

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

B= Attributable to field or laboratory contamination.
C= Confirmed on second column. U= Unconfirmed.
J= Estimated value. L= Result bias low.
K= Result bias high. R= Result rejected. #= Exceeds ecological screening value.

Table: J-8
Chemical Summary Report For Background Sediments

Units: UGG

	Site ID	E3-BCK-D01	E3-BCK-D04	E3-BCK-D08			
	Field Sample ID	DXBCK011	DXBCK041	DXBCK081			
	Sample Date	09/15/93	09/17/93	09/21/93			
Test	Parameter .						
TCL BNA	Indeno(1,2,3-cd)pyrene	0.690	< 0.330 R	< 0.660			
	PHEND5		0.410 R				
	Phenanthrene	2.20 #	< 0.330 R	< 0.660			
	Pyrene	2.70 #	< 0.330 R	< 0.660			
TCL Pest	Aldrin	0.001 BJU	0.007 C #	< 0.002			
	Endosulfan Sulfate	0.002 BJU	0.001 BJU	0.001 JC			
	Endosulfan,A	0.000 JC	0.002 JU	0.004 BU			
	Endrin	0.007 KC#	< 0.002 J	< 0.002 J			
	Heptachlor Epoxide	0.001 JC	0.001 JU	0.002 BJU			
	Lindane	0.001 JU	< 0.002 J	0.001 JC			
	P,P-DDE	0.002 JC	0.004 BU#	0.002 BJC			
	delta-BHC	0.002 JC	< 0.002	< 0.002			
TOC	Total Organic Carbon	7870	7690	14200			
TPHC	Total Petroleum Hydrocarbons	32.9 #	16.6 J#	< 20.0			

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

B= Attributable to field or laboratory contamination. J= Estimated value. L= Result bias low.
C= Confirmed on second column. U= Unconfirmed. K= Result bias high. R= Result rejected. #= Exceeds ecological screening value.

Date: 03/21/95
File Type: CSW
Site Type: POND

Table: J-9
Chemical Summary Report For Background Surface Waters

Units: UGL

	Site ID	E3-BCK-D01	E3-BCK-D04	E3-BCK-D08			
	Field Sample ID	WXBCK011	WXBCK041	WXBCK081			
	Sample Date	09/15/93	09/17/93	09/21/93			
Test	Parameter .						
EXPLOSIVES	2-Nitrotoluene	< 1.00	< 1.00	< 1.00			
TAL METAL	Aluminum	63.4 J	400 J	222 J			
	Arsenic	< 2.00	3.15 @	1.96 J@			
	Barium	39.0 J	10.4 J	9.04 J			
	Calcium	24100	8520	7690			
	Chromium	< 10.0 K	3.16 JK	2.90 JK			
	Cobalt	< 10.0	3.08 J	4.79 J			
	Iron	366 J	2770 J#	4810 J#			
	Lead	1.15 J	3.82 J#	10.3 #			
	Magnesium	2960	1760	1890			
	Manganese	315	156	120			
	Potassium	4140	2060	1640			
	Sodium	24300	14000	5760			
	Vanadium	< 10.0	4.72 J	4.08 J			
	Zinc	66.1	11.5 J	13.3 J			
TCL VOA	Tetrachloroethene	< 5.00	< 5.00	1.90 J@			
	Trichloroethene	< 5.00	< 5.00	1.80 J			
UN07	DIAZ	3.90	< 0.310	< 0.310			
WQP	Phosphorus, Total	< 10.0 J	280 J	110 J			

Source: USAEC IRDMIS Level 3/E & E, 1994 - Codes following values indicate data useability. (see below)

B= Attributable to field or laboratory contamination.
C= Confirmed on second column. U= Unconfirmed.
J= Estimated value. L= Result bias low. @= Exceeds human health screening value.
K= Result bias high. R= Result rejected. #= Exceeds ecological screening value.

K

APPENDIX K

ECOLOGICAL INVESTIGATION FIELD FORMS

APPENDIX K

ECOLOGICAL INVESTIGATION FIELD FORMS

Appendix K compiles the information gathered during the July 1993 ecological survey conducted at the two RI sites. Copies of the following field forms have been included:

- Field maps indicating the locations of individual cover types;
- Cover type description forms;
- Basal area field forms; and
- United States Corps of Engineers Wetland forms.
- United States Fish and Wildlife Service Wetlands Functions Evaluation forms.

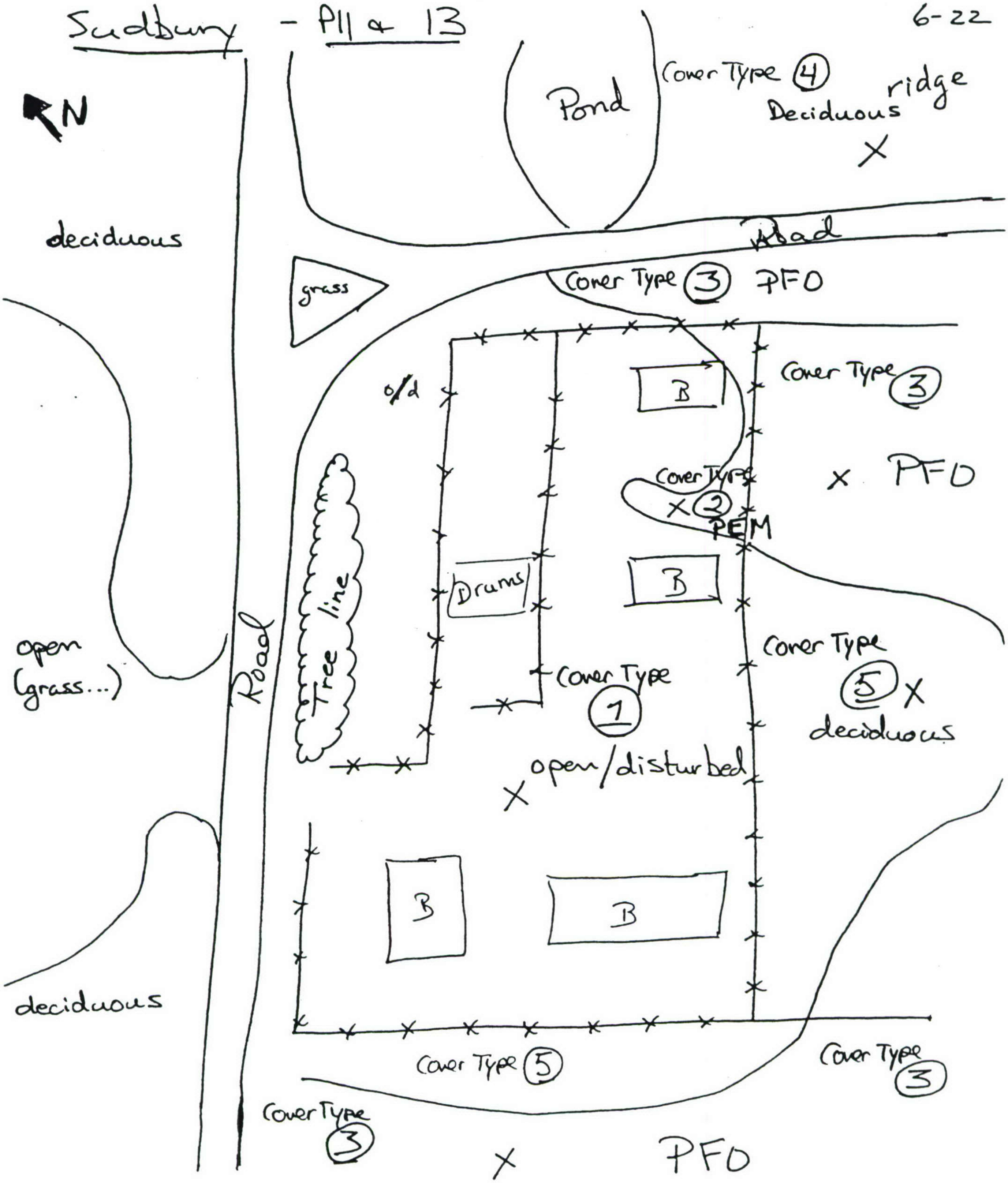
CONTENTS

RI SITE ENCOMPASSING P11 AND P13

- Field map
- For each cover type (5 total)
  - Cover type description form
  - Basal area field form
  - United States Corps of Engineers Wetland forms (except for cover type 5)
- For each wetland (2 total)
  - United States Fish and Wildlife Service Wetlands Functions Evaluation forms

Sudbury - P11 & 13

6-22



COVER TYPE DESCRIPTION FORM

Project: Sudbury Annex, P11 & 13
Field Crew: Kim, Vangalio, Azzopardi

Date: 6-22
Photo #(s): 3-23, 24 & 25

Cover Type No.: 1
Cover Type Name: Open/disturbed

VEGETATION: (* = dominants)

Trees (~~DBH~~ veg. density= scattered (not in plot)
red maple black locust
red cedar

Saplings/shrubs (veg. density= scattered):
multiflora rose slippery elm white ash
rubus spp. red maple lowbush blueberry

Woody Vines (veg. density= along edges):
poison ivy

Herbs (veg. density= 80):
orchard grass* yarrow poverty grass goldenrods
Kentucky bluegrass* cinquefoil bedstraw

Comments (diversity, quality, exotics):
- shrubs occur around buildings
- areas of pavement (roads & sidewalks); numerous buildings

SLOPE: 3-5%

SOIL COMPOSITION: disturbed

HYDROLOGY: absent

WATER BODIES: two intermittent streams on the W and E sides; one small drainage in center (see cover type 2)

WILDLIFE:

Species Observed:

Other Evidence of Wildlife Use:

Wildlife Values:
- ____ travel corridors
- ____ abundance of cover
- ✓ abundance of food
- ✓ abundance of edge
- ____ cavity trees
- ____ standing dead snags
- ____ large, contiguous fore:

Available Wildlife Foods:
berries, seeds

DISTURBANCE: (fire, logging, ditching, stressed veg., stained soils, drums
- roads, buildings, fences, drums, sidewalks ...

BASAL AREA FIELD FORM

Project: Sudbury Annex, P11 & 13
Cover type number: 1
Plot radius: ~30'

Date: 6-22
Crew: Azzopardi, Kim, Vangalio

DBH(in.)	Midpt.	BA/tree	SPECIES					
4-6	5	19.63						
6-8	7	38.47						
8-10	9	63.59						
10-12	11	94.99						
12-14	13	132.67						
14-16	15	176.63						
16-18	17	226.87						
18-20	19	283.39		No Trees (in plot)				
20-22	21	346.19						
22-24	23	415.27						
24-26	25	490.63						
26-28	27	572.27						
28-30	29	660.19						
30-32	31	754.39						
32-34	33	854.87						
34-36	35	961.63						
Total BA/species								
Total BA/plot								
Relative dominance (%)								

FOR USE WITH 1987 CORPS WETLANDS DELINEATION MANUAL

Project Title: Sudburry P11 P13

File Number:

Cover type 1 ~~Transect~~: Plot:

Date: 6-22-93

DATA -- VEGETATION	Stratum and Species (DOMINANTS ONLY)	Dominance Ratio	Percent Dominance	NWI Status
Tree				
none				

Note: use asterisk * to indicate FAC-, FACU, or UPL species with observed adaptions to wetland hydrology

TALLY (Dominants ONLY)

OBL	FACW	FAC	*FAC-	*FACU	*UPL	FAC-	FACU	UPL
____	____	____	____	____	____	____	____	____

SUBTOTAL (HYDROPHYTES): ______ SUBTOTAL: ______

TOTAL: ______

$\frac{100 \times \text{SUBTOTAL (HYDROPHYTES)}}{\text{TOTAL}}$ = ______ = PERCENT HYDROPHYTES

DESCRIBE VEGETATION DISTURBANCE:

DESCRIBE ADAPTATIONS:

DATA -- SOIL

Soil Taxonomy: Typic Dystrochrept

Corps of Engineers Regional Drainage Class: somewhat excess drained

Criterion:

Is Published Soil Survey Available? Yes ☒ No ☐

Title/Date: Middlesex Conty 1991

Soil Type Mapped: Merrimac

Field Observations Confirm Type Mapped? Yes ☒ No ☐

Depth	Horizon	Matrix Color (Munsell, Moist)	Color of Mottles (Munsell, Moist) Abundance/Contrast	USDA Texture, Iron or manganese nodules or concretions, restrictive layers, root distribution, oxidized rhizospheres, etc.
0-1				roots
1-9		7.5 YR 3/3	none	silty sand
9-12		7.5 YR 5/8	none	sandy
12 - obstruction				

Remarks:

Sketch Landscape Position:

FOR USE WITH 1987 CORPS WETLANDS DELINEATION MANUAL

SOIL DETERMINATION

NOTE:
1. "NO" to all the following is evidence that the soil is NOT HYDRIC
2. This checklist is valid for use by the New England Corps of Engineers; use outside the six New England States may be inappropriate
3. This interpretive routine may be inappropriate in unusual cases

Yes	No	
☐	☒	Soil is frequently PONDED or FLOODED for a duration longer than two weeks during the growing season. (attach an explanation of the basis for your conclusions).
☐	☒	The soil meets the Corps of Engineers regional criteria as a VERY POORLY DRAINED SOIL* and there is no evidence of altered hydrology
☐	☒	The soil meets the Corps of Engineers regional criteria as a POORLY DRAINED SOIL* and there is no evidence of altered hydrology
☐	☒	The soil meets the Corps of Engineers regional criteria as a SOMEWHAT POORLY DRAINED SOIL that has either of the following two characteristics*:

Yes NO
☐ ☐ 1. Within 8 inches of the soil surface there are:

Yes No
- ☐ ☐ a. soil mottles within an A or Ap horizon and the subsoil is mottled throughout; OR
- ☐ ☐ b. common to many, distinct or prominent mottles with a matrix of chroma 3 or less; OR
- ☐ ☐ c. distinct or prominent oxidized rhizospheres and the subsoil is mottled throughout.

☐ ☐ 2. Within 24 inches of the soil surface, there are mottles which are common to many, distinct or prominent, and that are chroma 2 or less, and one of the following:

Yes No
- ☐ ☐ a. In the horizon that lies within 10 inches of the soil surface and directly beneath a dark** A or Ap horizon, the matrix is chroma 3 or less; the mottles are at least 10% in abundance and distinct or prominent.
- ☐ ☐ b. When a dark** Ap horizon is between 10 and 14 inches thick, wetness morphology may be masked by organic matter. Normally, these problem situations will be considered hydric when: i. hydrophytes are prevalent, ii. there is no evidence of altered hydrology, and iii. in the horizon that lies directly beneath the Ap horizon, the matrix color is chroma 3 or less and mottles are at least 10% in abundance and distinct or prominent.

☐ Check here and attach a description of your procedures and conclusions if one of the following options were chosen for your hydric soil determination: measured redox potentials, colormetric test for ferrous iron test (α,α,-Dipyridil), or other measurements and observations.

* Typically in New England, soils having these morphologies will be classified in an aquic suborder or an aquic subgroup in soil taxonomy.
** Note: a dark A or Ap is defined as having a value of 3 or less and a chroma of 2 or less

Remarks:

DATA & DETERMINATION HYDROLOGY

NOTE
1. Hydrology is often the most difficult feature to observe
2. Interpretations must consider the appropriateness of the observations in light of the season, recent weather conditions, and watershed alterations, etc
3. Interpretation of hydrology may require repeated observations over more than one season

☐ Recorded Data:
- Stream, lake or tidal gage — Identification: ______
- Aerial Photograph — Identification: ______
- Other — Identification: ______

☐ No Recorded Data Available

REPORT ANY OF THE FOLLOWING OBSERVATIONS:

- Depth to Free Water: >18"
- Depth to Saturation: >18"
- Describe Altered Hydrology: ______

- ☐ Inundated
- ☐ Saturated in upper 12 inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns within Wetlands

Remarks

CONCLUSIONS

Project Title:

Delineator:

Transect: Plot: Date:

	Yes	No
Greater than 50 Percent Hydrophytes?	☐	☐
Hydric Soils Criterion Met?	☐	☒
Wetland Hydrology Present?	☐	☒

IS THIS DATAPOINT WITHIN A WETLAND? Yes ☐ No ☐

Remarks

COVER TYPE DESCRIPTION FORM

Project: Sudbury Annex, P11 & 13
Field Crew: Vangalio, Azzopardi, Kim

Date: 6-22
Photo #(s): 4-1

Cover Type No.: 2
Cover Type Name: Wet meadow (PEM)

VEGETATION: (* = dominants)

Trees (DBH= veg. density= 0
none

Saplings/shrubs (veg. density= 10):
meadowsweet highbush blueberry
northern arrowwood

Woody Vines (veg. density= 0):
none

Herbs (veg. density= 98):
sensitive fern slender blue iris cutgrass
tearthumb cinnamon fern

Comments (diversity, quality, exotics):
- drainge has been culverted
- soil is moist and very thick

SOIL COMPOSITION: 7.5 YR 2/0

SLOPE: 0-3%

HYDROLOGY: present

WATER BODIES: intermittent stream/drainage

WILDLIFE:

Species Observed:

Other Evidence of Wildlife Use:

Wildlife Values:
- ___ travel corridors
- ___ abundance of cover
- ✓ abundance of food
- ✓ abundance of edge
- ___ cavity trees
- ___ standing dead snags
- ___ large, contiguous fore

Available Wildlife Foods:
berries, seeds

DISTURBANCE: (fire, logging, ditching, stressed veg., stained soils, drums
- area has been cleared/cut in the past

BASAL AREA FIELD FORM

Project: Sudbury Annex, P11 & 13
Cover type number: 2
Plot radius: ~30'

Date: 6-22
Crew: Azzopardi, Vangalio, Kim

DBH(in.)	Midpt.	BA/tree	SPECIES					
4-6	5	19.63						
6-8	7	38.47						
8-10	9	63.59						
10-12	11	94.99						
12-14	13	132.67						
14-16	15	176.63						
16-18	17	226.87						
18-20	19	283.39		No	Trees			
20-22	21	346.19						
22-24	23	415.27						
24-26	25	490.63						
26-28	27	572.27						
28-30	29	660.19						
30-32	31	754.39						
32-34	33	854.87						
34-36	35	961.63						
Total BA/species								
Total BA/plot								
Relative dominance (%)								

FOR USE WITH 1987 CORPS WETLANDS DELINEATION MANUAL

Project Title: Sudburry P11 P13 File Number:

Cover type 2 ~~Transect~~ Plot: Date: 6-22-93

DATA -- VEGETATION Stratum and Species (DOMINANTS ONLY)	Dominance Ratio	Percent Dominance	NWI Status

Note: use asterisk * to indicate FAC-, FACU, or UPL species with observed adaptions to wetland hydrology

TALLY (Dominants ONLY)

OBL	FACW	FAC	*FAC-	*FACU	*UPL	FAC-	FACU	UPL

SUBTOTAL (HYDROPHYTES): ______ SUBTOTAL: ______

TOTAL: ______

$\frac{100 \times \text{SUBTOTAL (HYDROPHYTES)}}{\text{TOTAL}}$ = ______ = PERCENT HYDROPHYTES

DESCRIBE VEGETATION DISTURBANCE:

DESCRIBE ADAPTATIONS

DATA -- SOIL Soil Taxonomy: Histic Humaquept

Corps of Engineers Regional Drainage Class: very poorly drained Criterion: A3

Is Published Soil Survey Available? Yes ☒ No ☐ Title/Date: Middlesex County 1991

Soil Type Mapped: Scarboro Field Observations Confirm Type Mapped? Yes ☒ No ☐

Depth	Horizon	Matrix Color (Munsell, Moist)	Color of Mottles (Munsell, Moist) Abundance/Contrast	USDA Texture, Iron or manganese nodules or concretions, restrictive layers, root distribution, oxidized rhizospheres, etc.
0-3				decayed grass, roots
3-8		7.5YR3/2	none	
>8		N2/0		

Remarks:

Sketch Landscape Position:

FOR USE WITH 1987 CORPS WETLANDS DELINEATION MANUAL

SOIL DETERMINATION

NOTE:
1. "NO" to all the following is evidence that the soil is NOT HYDRIC
2. This checklist is valid for use by the New England Corps of Engineers, use outside the six New England States may be inappropriate
3. This interpretive routine may be inappropriate in unusual cases

Yes No

☐ ☒ Soil is frequently PONDED or FLOODED for a duration longer than two weeks during the growing season. (attach an explanation of the basis for your conclusions).

☒ ☐ The soil meets the Corps of Engineers regional criteria as a VERY POORLY DRAINED SOIL* and there is no evidence of altered hydrology.

☐ ☒ The soil meets the Corps of Engineers regional criteria as a POORLY DRAINED SOIL* and there is no evidence of altered hydrology

☐ ☒ The soil meets the Corps of Engineers regional criteria as a SOMEWHAT POORLY DRAINED SOIL that has either of the following two characteristics*:

Yes NO

☐ ☐ 1. Within 8 inches of the soil surface there are:

Yes No

- ☐ ☐ a. soil mottles within an A or Ap horizon and the subsoil is mottled throughout; OR
- ☐ ☐ b. common to many, distinct or prominent mottles with a matrix of chrome 3 or less; OR
- ☐ ☐ c. distinct or prominent oxidized rhizospheres and the subsoil is mottled throughout.

☐ ☐ 2. Within 24 inches of the soil surface, there are mottles which are common to many, distinct or prominent, and that are chrome 2 or less, and one of the following:

Yes No

- ☐ ☐ a. In the horizon that lies within 10 inches of the soil surface and directly beneath a dark** A or Ap horizon, the matrix is chrome 3 or less; the mottles are at least 10% in abundance and distinct or prominent.
- ☐ ☐ b. When a dark** Ap horizon is between 10 and 14 inches thick, wetness morphology may be masked by organic matter. Normally, these problem situations will be considered hydric when: I. hydrophytes are prevalent, II. there is no evidence of altered hydrology, and III. in the horizon that lies directly beneath the Ap horizon, the matrix color is chrome 3 or less and mottles are at least 10% in abundance and distinct or prominent.

☐ Check here and attach a description of your procedures and conclusions if one of the following options were chosen for your hydric soil determination: measured redox potentials, colormetric test for ferrous iron test (α,α,-Dipyridil), or other measurements and observations.

* Typically in New England, soils having these morphologies will be classified in an aquic suborder or an aquic subgroup in soil taxonomy.
** Note: a dark A or Ap is defined as having a value of 3 or less and a chrome of 2 or less

Remarks:

DATA & DETERMINATION HYDROLOGY

NOTE:
1. Hydrology is often the most difficult feature to observe
2. Interpretations must consider the appropriateness of the observations in light of the season, recent weather conditions, and watershed alterations, etc
3. Interpretation of hydrology may require repeated observations over more than one season

☐ Recorded Data:

- Stream, lake or tidal gage — Identification:
- Aerial Photograph — Identification:
- Other — Identification:

☐ No Recorded Data Available

REPORT ANY OF THE FOLLOWING OBSERVATIONS:

Depth to Free Water: 12"

Depth to Saturation: 8"

Describe Altered Hydrology:

- ☐ Inundated
- ☒ Saturated in upper 12 inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☒ Drainage Patterns within Wetlands

Remarks:

CONCLUSIONS

Project Title:

Delineator:

Transect: Plot: Date:

	Yes	No
Greater than 50 Percent Hydrophytes?	☐	☐
Hydric Soils Criterion Met?	☒	☐
Wetland Hydrology Present?	☒	☐

IS THIS DATAPOINT WITHIN A WETLAND? Yes ☐ No ☐

Remarks:

WETLAND INVENTORY DATA

Key

- L Low
- M Moderate
- H High
- U Unfavorable
- A Absent
- P Perennial
- E Ephemeral

Project No. P11/P13
Wetland No. Cdn typi 2

ECOLOGICAL ELEMENTS

Wetland Subclasses

- ☐ Stream or Brookside Wetland
- Open Fresh Water
  - ☐ Non-vegetated Subclass
- Deep Fresh Marsh
  - ☐ Dead Woody ☐ Shrub
  - ☐ Scrub-Shrub ☐ Robust
  - ☐ Narrow-leaved ☐ Broad-leaved
- Shallow Fresh Marsh
  - ☐ Robust ☐ Narrow-leaved
  - ☐ Broad-leaved ☐ Floating-leaved
- Floodplain/Flats
  - ☐ Emergent
  - ☐ Shrubs and Trees
- Wet Meadow
  - ☒ Ungrazed ☐ Grazed
- Shrub Swamp
  - ☐ Sapling ☐ Bushy
  - ☐ Compact ☐ Aquatic
- Wooded Swamp
  - ☐ Deciduous ☐ Evergreen
- Bog
  - ☐ Shrub ☐ Wooded
  - ☐ Cranberry ☐ Moss
- Fen
  - ☐ Emergent ☐ Shrub

SPECIAL ELEMENTS

- ☐ Rare and/or Endangered Species
- ☐ Aquatic Study Area
- ☐ Sanctuary or Refuge
- ☐ Wildlife Management Area
- ☐ Fisheries Management Area
- ☐ Educational Study Area
- ☐ Historical Area
- ☐ Other________

Dominant Wetland Class

- ☐ Stream or Brookside Wetland
- ☐ Open Fresh Water
- ☐ Deep Fresh Marsh
- ☐ Shallow Fresh Marsh
- ☐ Yearly Floodplain
- ☒ Wet Meadow
- ☐ Shrub Swamp
- ☐ Wooded Swamp
- ☐ Bog
- ☐ Fen
- ☐ Other________

Wetland Class Richness
☐ >5 ☐ 4 ☐ 3 ☒ 2 ☐ 1

Subclass Richness (Lateral Diversity)
☐ >10 ☐ 9-6 ☐ 5-4 ☒ 3-2 ☐ 1

Vegetative Interspersion
☐ H ☐ M ☒ L

Surrounding Habitat

- ☐ >90% of 2 or more listed types
- ☒ 50-90% of 1 or more; 90% of 1
- ☐ <50% of 1 or more of listed types

Cover Type

- ☐ 26-75% scattered
- ☐ 26-75% peripheral
- ☐ >75% or <25% scattered
- ☒ 100% cover; >75% or <25% peripheral

Percent Open Water
☒ 0-33% ☐ 34-66% ☐ 67-95% ☐ 96-100%

Vegetative Species Richness
☐ H ☐ M ☒ L

Proportion of Wildlife Food Plants
☐ H ☐ M ☒ L

Vegetative Density
☐ H ☐ M ☒ L

Wetland Juxtaposition Favorability
☐ H ☐ M ☒ U

TOPOGRAPHICAL ELEMENTS

Topographic Configuration

- ☐ Closed Basin
- ☒ Semi-closed Basin
- ☐ Valley
- ☐ Hillside

Size

- ☐ Large ≥4.6 acres
- ☐ Medium 1.1-4.5
- ☒ Small ≤1 acre

Wetland Gradient
☒ Slight 0-3% ☐ Steep >3%

Surrounding Slopes
☒ Slight 0-3% ☐ Steep >3%

Topographic Position in Watershed
☐ Upper ☐ Intermediate ☒ Lower

GEOLOGICAL ELEMENTS

Surficial Geologic Material Underlying Wetland

- ☐ Till ☒ Alluvium
- ☐ Stratified Sand and Gravel
- ☐ Stratified Fine Sand and Silt

Bedrock Underlying Wetland

- ☐ Igneous and Metamorphic
- ☐ Sedimentary

Soil Type/Permeability
☐ Peat/H ☐ Mineral/M ☒ Muck/L

Dominant Surficial Geological Material of Watershed

- ☐ Till ☒ Alluvium
- ☐ Stratified Sand and Gravel
- ☐ Stratified Fine Sand and Silt

Thickness of Organics
☐ <1 foot ☒ 1-5 feet ☐ >5 feet

HYDROLOGICAL ELEMENTS

Hydrologic Position of Wetland

- ☐ Perched Wetland
- ☒ Water Table Wetland
- ☐ Water/Artesian Wetland
- ☐ Artesian Wetland

Groundwater Relationship

- ☐ Discharge Wetland
- ☒ Recharge Wetland
- ☐ Combination

Transmissivity of Aquifer

- ☒ Low <10,000 gal/day/ft
- ☐ Moderate 10,000 - 40,000 gal/day/ft
- ☐ High >40,000 gal/day/ft

Dominant Hydrologic Condition
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☒ 5 ☐ 6

Connection by Surface Water to a Riparian System
☒ Yes ☐ No

Watershed Land Use

- ☐ Rural
- ☐ Rural/Residential
- ☒ Urban
- ☐ Industrial
- ☐ Other________

Water Level Fluctuation
☐ H ☒ L ☐ Vernal Pool

Groundwater Outflow From Wetland
☐ Absent ☒ Present

Inlet
☐ A ☐ P ☒ E
☐ Present, to wetland________

Inlet
☐ A ☐ P ☐ E
☐ Present, to wetland________

Inlet
☐ A ☐ P ☐ E
☐ Present, to wetland________

Inlet
☐ A ☐ P ☐ E
☐ Present, to wetland________

Inlet
☐ A ☐ P ☐ E
☐ Present, to wetland________

Outlet
☐ A ☐ P ☒ E
☐ Present, to wetland________

Outlet
☐ A ☐ P ☐ E
☐ Present, to wetland________

Percent Wetlands Bordering Open Water vs. Upland
☒ <33% ☐ 34-66% ☐ 67-100%
☐ Does not border

Fetch
☐ >2000 ft. ☐ <2000 ft.

Depth of Lake
☐ Deep >6 ft. ☐ Shallow <6 ft.

SOCIO-ECONOMICAL ELEMENTS

Hydrologically Connected to a

- ☒ Small stream
- ☐ River
- ☐ Lake
- ☐ Combination
- ☐ Not connected

Public Access to Wetland

- ☒ Within 100 ft. of road
- ☐ Access by passable waterway
- ☐ Isolated

Surrounding Population Density

- ☐ <½ person/acre (<320/mi^2)
- ☐ 0.5 - 1.9 p/a (320-1220/mi^2)
- ☒ >2 p/a (>1220/mi^2)

Local Scarcity to Nearest Similar Type

- ☐ <200 feet
- ☒ 201 to 1000 feet
- ☐ >1000 feet

Known Crop Value or Potential

- ☒ None
- ☐ Supports 1 family for part of year
  Type________
- ☐ Supports viable commercial interest
  Type________

Legal Accessibility to Wetland
☐ Public ☐ Private ☒ Restricted

Cultural Significance
☐ Archeological/Historic ☒ None

Figure 9. Biological Function Model

Elements	Element Weight	Condition Weight	
Unique Fisheries[a]	NA[b]	NA	Present
		NA	Not Present
Presence of Endangered or Threatened Species[a]	NA	NA	Present
		NA	Not Present
Dominant Wetland Class	5	1	Stream or Brookside wetland
		0	Open fresh water
		4	Deep fresh marsh(aquatic bed)
		5	Shallow fresh marsh
	10	5	Yearly flooded floodplain
		2	Wet meadow
		4	Shrub swamp
		2	Wooded swamp (deciduous)
		4	Wooded swamp (coniferous)
		3	Bog
Number of Wetland Classes (Richness)	4	5	>5
		4	4
		3	3
	8	2	2
		1	1
Number of Wetland Subclasses (Richness)	3	5	>10
		4	6-9
		3	4-5
	6	2	2-3
		1	1
Vegetative Interspersion	4	3	High
		2	Moderate
	4	1	Low
Surrounding Habitat	3	3	>90% of two or more of listed types
	6	2	50-90% of one or more 90% of one
		1	<50% of one or more listed
Water/Cover Ratio (Cover Typed)	3	4	25-75% scattered
		2	25-75% peripheral
	3	3	75% or <25% scattered
		1	100% cover:>75% or 25% peripheral
Number of Plant Species (Vegetative Species Richness)	2	1	Low
	2	2	Medium
		3	High
Proportion of Wildlife Food Plants	1	1	Low
		2	Moderate
	1	3	High
Vegetative Density	2	3	High
	2	2	Moderate
		1	Low
Wetland Juxtaposition	3	3	Highly favorable
	0	2	Moderately favorable
		0	Unfavorable
Hydrological Position (Groundwater Connection)	2	1	Perched wetland
	8	4	Water table wetland
		3	Water table/artesian wetland
		3	Artesian wetland
Water Level Fluctuation	1	2	Low
	2	1	Vernal pool
		0	High

Figure 9 (continued)

Elements	Element Weight	Condition Weight	Conditions
Surface Water	1	1	Connected to a small stream
		2	Connected to a river
	1	3	Connected to a lake
		4	Connected to a combination
		0	Not connected
Percent Wetland Bordering on Open water	4	1	<33%
		2	34-66%
	4	3	67-100%
		0	Does not border
Size	5	3	Large ≥ 4.6 acres
	5	2	Medium 1.1-4.5 acres
		1	Small ≤ 1.0 acres
		Range 29-158 Mean 93	
		62	

a-preemptive factors
b-not applicable

29-72 Low
~~72~~ 73-115 med
116-158 High

Figure 10. Hydrologic Support Function Model

Elements	Element Weight	Condition Weight	Conditions
Size	4	3	Large ≥ 4.6 acres
		2	Moderate 1.1-4.5 acres
	4	1	Small ≤ 1.0 acres
Topographic Configuration	1	3	Semi-closed basin
		2	Valley
	3	1	Hillside
		0	Closed Basin
Dominant Hydrologic Type	5	1	Condition 1
		2	Condition 2
		3	Condition 3
	25	4	Condition 4
		5	Condition 5
		0	Condition 6
Water Level Fluctuation	2	2	Low
	4	1	High
Outlet	4	2	Perennial Outlet
	4	1	Ephemeral Outlet
		1	Groundwater Outflow
		0	Absent
Inlet	1	2	Perennial
	1	1	Ephemeral
		0	Absent
Percent Wetland[a] Bordering on Open Water	4	1	<33%
	4	2	34-66%
		3	67-100%
		0	Does not border
	45	Range 6-70[b] Mean 36	

[a] Applies only to those wetlands with an outlet
[b] Total value for one inlet and one outlet only.

6-27 Low
28-49 Med
50-70 H

Figure 11. Groundwater Function Model

Elements	Element Weight	Condition Weight	Conditions
Surficial Geology	3	1	Till
		4	Stratified sand and gravel
	6	3	Stratified fine sand and silt
		2	Alluvium
Organic Material	2	3	Absent
	2	2	High permeability
		1	Low permeability
Hydrologic Position	5	2	Perched wetland
		4	Water table wetland
	20	2	Water table/artesian wetland
		1	Artesian wetland
Transmissivity of Aquifer	4	1	Low <10,000 gal/day/ft
	4	2	Med. 10,000-40,000 gal/day/ft
		3	High >40,000 gal/day/ft
Inlet	1	1	Absent
		3	Perennial
	2	2	Ephemeral
Outlet	2	3	Absent
		2	Perennial
	2	1	Ephemeral
Size	3	3	Large ≤ 4.6 acres
	3	2	Medium 1.1-4.5 acres
		1	Small ≥ 1.0 acres
	39	Range 20-68[a] Mean 44	20-36 Low

[a] Total value for one inlet and one outlet only. Some wetlands may have more than one inlet or outlet but the range above is for wetlands with only one inlet and one outlet.

37-52 Med.

53-68 High

Figure 12. Storm and Flood Water Storage Function Model

Elements	Element Weight	Condition Weight	Conditions
Dominant Wetland Class	2	1	Stream or brookside wetland
		1	Open fresh water
		2	Deep fresh marsh (aquatic bed)
	6	4	Shallow fresh marsh
		4	Yearly flooded floodplain
		3	Wet meadow
		5	Shrub swamp
		4	Wooded swamp
		3	Bog
Percent Open Water	2	3	0-33%
		2	34-66%
	6	1	67-95%
		0	96-100%
Vegetative Density	4	3	High
		2	Moderate
	4	1	Low
Topographic Configuration	2	4	Closed Basin
	6	3	Semi-closed basin
		2	Valley
		1	Hillside
Topographic Position in Watershed	3	3	Upper
	3	2	Intermediate
		1	Lower

Figure 12 (continued)

Elements	Element Weight	Condition Weight	Conditions
Surficial Material of Watershed	2	4	Till
	4	1	Stratified sand and gravel
		3	Stratified fine sand and silt
		2	Alluvium
Surficial Geologic Material of Wetland Banks	2	1	Till
		4	Stratified sand and gravel
	6	2	Stratified find sand and silt
		3	Alluvium
Organic Material	1	2	High permeability
	1	1	Low permeability
		0	Absent
Dominant Hydrologic Type	5	1	Condition 1
		2	Condition 2
		3	Condition 3
	25	4	Condition 4
		5	Condition 5
		6	Condition 6
Hydrologic Connection	4	1	Not part of riparian system
	8	2	Part of riparian system
Water Level Fluctuation	3	2	High
	3	1	Low
Inlet	1	2	Perennial
	1	1	Ephemeral
		0	Absent
Outlet	1	1	Perrennial
	2	2	Ephemeral
		0	Absent
Size	4	3	Large ≥ 4.6 acres
		2	Medium 1.1-4.5 acres
	4	1	Small ≤ 1.0 acres
	79	Range 31-123 Mean 77	

[a]Total value for one inlet and one outlet only. Some wetlands may have more than one inlet or outlet but the range above is for wetlands with only one inlet and one outlet.

31-62 low

63-94 Med

95-123 High

Figure 13. Shoreline Protection Function Model

Element	Element Weight	Condition Weight	Condition
Wetland Borders[a] Lake or Stream	NA[b]	NA	Yes
		NA	No
Vegetative Density	3	0	Open fresh water
		0	Stream and brookside
		1	Deep fresh marsh (aquatic bed)
		2	Shallow fresh marsh
	3	4	Yearly floodplan
		1	Wet meadow
		4	Shrub swamp
		4	Wood swamp
		3	Bog
Surficial Material Underlying Wetland	1	2	Till
		1	Stratified sand and gravel
	3	4	Stratified find sand and silt
		3	Alluvium
Fetch (Lakes only)	4	2	Over 2000 ft.
		1	Under 2000 ft.
Depth of Lake	1	2	Deep 6 ft.
		1	Shallow 6 ft.
	6	Range 3-32 Mean 17	low 3-12 mod 13-22 high 23-32

[a]preemtive
[b]not applicable

Figure 14. Water Quality Maintenance Function Model

Elements	Element Weight	Condition Weight	Conditions
Dominant Wetland Class	4	1	Stream or brookside wetland
		0	Open fresh water
		3	Deep fresh marsh (aquatic bed)
		4	Shallow fresh marsh
	12	4	Yearly floodplain
		3	Wet meadow
		4	Shrub Swamp
		2	Wooded swamp
		2	Bog
Percent open water	1	3	0-33%
		2	34-66%
	3	1	67-95%
		0	96-100%
Vegetative Density	3	3	High
	3	2	Moderate
		1	Low
Topographic Configuration	3	4	Closed Basin
		3	Semi-closed basin
	9	2	Valley
		1	Hillside
Topographic Position in Watershed	2	1	Upper
	6	2	Intermediate
		3	Lower
Organic Material	1	1	High permeability
	2	2	Low permeability
		0	Absent

Figure 14 (continued)

Elements	Element Weight	Condition Weight	Conditions
Dominant Hydrologic Type	4	1	Condition 1
		2	Condition 2
		3	Condition 3
	20	4	Condition 4
		5	Condition 5
		6	Condition 6
Hydrologic Connection	2	1	Not part of the riparian system
	4	2	Part of riparian system
Inlet	2	2	Perennial
	2	1	Ephemeral
		0	Absent
Outlet	3	2	Perennial
	3	1	Ephemeral
		0	Absent
Size	4	3	Large ≥ 4.6 acres
	4	2	Moderate 1.1-4.5 acres
		1	Small ≤ 1.0 acres
		Range 18-98[a] Mean 58	

[a]Total value for one inlet and one outlet only. Some wetlands may have more than one inlet or outlet but the range above is only for wetlands with one inlet and one outlet.

68

Low 18-45
mod 46-72
High 73-98

Figure 15. Cultural and Economic Function Model

Elements	Element Weight	Condition Weight	Conditions
Dominant Wetland Class	4	0	Stream of brookside
		0	Open fresh water
		4	Deep fresh marsh
	8	4	Shallow fresh marsh
		0	Yearly flooded floodplain
		2	Wet meadow
		3	Shrub swamp
		5	Wooded swamp (deciduous)
		6	Wooded swamp (coniferous)
		3	Bog
Access	3	3	Within 100' of road
	9	2	Access by passable waterway
		1	Isolated
Size	8	3	Large ≥ 4.6 acres
	8	2	Medium 1.1-4.5 acres
		1	Small ≤ 1.0 acres
		Range 11–57 Mean 34	

25

11-26
27-41
42-57

Figure 16. Recreational Function Model

Elements	Element Weight	Condition Weight	Conditions
Dominant Wetland Class	3	0	Stream or brookside
		0	Open fresh water
		6	Deep fresh marsh
		5	Shallow fresh marsh
	0	0	Yearly flooded floodplain
		0	Wet meadow
		2	Shrub swamp
		2	Wooded swamp (deciduous)
		3	Wooded swamp (coniferous)
		2	Bog
Percent Open Water	3	1	0-33%
	3	2	34-66%
		3	67-95%
		0	96-100%
Surface Water Association	4	1	Connected to a small stream
	4	2	Connected to a river
		3	Connected to a lake
		4	Connected to a combination
		0	Not connected
Access to Public	2	3	Within 100' of road
	6	2	Access by passable waterway
		1	Isolated
Size	4	3	Large ≥ 4.6 acres
	4	2	Medium 1.1-4.5 acres
		1	Small ≤ 1.0 acres
Legal Access	2	2	Yes
	2	1	No
Output From Biological Function	3	3	High 116-158
	3	2	Moderate 73-115
		1	Low 29-72

22 Range 11-74
Mean 42

Low 11-32
Med 33-53
High 54-74

Figure 17. Aesthetic Function Model

Elements	Element Weight	Condition Weight	Conditions
Dominant Wetland Class	4	0	Stream or brookside wetland
		0	Open fresh water
		5	Deep fresh marsh
		4	Shallow fresh marsh
	0	0	Yearly flooded floodplain
		0	Wet meadow
		2	Shrub swamp
		3	Wooded swamp (deciduous)
		3	Wooded swamp (coniferous)
		5	Bog
Number of Subclasses (Richness)	3	4	6-9
	6	2	2-3
		1	1
Percent Open Water	4	1	0-33%
		3	34-66%
	4	4	67-95%
		0	96-100%
Access to Public	3	3	Within 100 ft. of road
	9	2	Access by passable waterway
		1	Isolated
Local Scarcity	3	1	<200 ft. to nearest similar type
	6	2	201-1000 ft to nearest similar type
		3	>1000 ft. to nearest Similar type

Range 9-66
Mean 37

25
9-28 L
29-47 M
48-66 H

Figure 18. Educational Function Model

Elements	Element Weight	Condition Weight	Conditions
Subclass Richness (Lateral Diversity)	3	4	6-9
	6	3	4-5
		2	2-3
		1	1
Access to Public	4	3	Within 100' of road
	12	2	Access by passable waterway
		1	Isolated

18 Range 7-24
Mean 15

7-12 L
13-18 M
19-24 H

COVER TYPE DESCRIPTION FORM

Project: Sudbury Annex, P11 & 13
Field Crew: Kim, Azzopardi, Vangalio

Date: 6-22
Photo #(s): 4-2

Cover Type No.: 3
Cover Type Name: Red maple - cinnamon fern forested wetland (PFO)

VEGETATION: (* = dominants)

Trees (~~DBH~~ veg. density= 85
red maple * slippery elm

Saplings/shrubs (veg. density= 20):
white pine red maple

Woody Vines (veg. density= 0):
none

Herbs (veg. density= 30):
skunk cabbage cinnamon fern royal fern jewelweed
sphagnum moss grasses highbush blueberry

Comments (diversity, quality, exotics):
- very immature stand
- herb. density is 80% in the eastern end (more fern & cabbage)

SOIL COMPOSITION: 7.5 YR 2/0 muck

SLOPE:

HYDROLOGY: present

WATER BODIES: intermittent strea[m] and dredged channels

WILDLIFE:

Species Observed:
deer (scat)
raccoon (tracks)

Other Evidence of Wildlife Use:

Wildlife Values:

___	travel corridors
✓	abundance of cover
___	abundance of food
✓	abundance of edge
___	cavity trees
✓	standing dead snags
___	large, contiguous fore[st]

Available Wildlife Foods:
berries, seeds

DISTURBANCE: (fire, logging, ditching, stressed veg., stained soils, drums
- 2 dredged channels behind the PEM (cover type 2)
- old roads through area

BASAL AREA FIELD FORM

Project: Sudbury Annex, P11 & 13
Cover type number: 3
Plot radius: ~30'

Date: 6-22
Crew: Vangalio, Kim, Azzopardi

DBH(in.)	Midpt.	BA/tree	red maple	slippery elm	SPECIES			
4-6	5	19.63	卌 卌 卌 |||	||				
6-8	7	38.47	卌 ||||					
8-10	9	63.59	卌					
10-12	11	94.99						
12-14	13	132.67						
14-16	15	176.63						
16-18	17	226.87						
18-20	19	283.39						
20-22	21	346.19						
22-24	23	415.27						
24-26	25	490.63						
26-28	27	572.27						
28-30	29	660.19						
30-32	31	754.39						
32-34	33	854.87						
34-36	35	961.63						
Total BA/species			1017.52	39.26				
Total BA/plot			1056.78 →					
Relative dominance (%)			96	4				

FOR USE WITH 1987 CORPS WETLANDS DELINEATION MANUAL

Project Title: Sudburry P11 P13

File Number:

Cover type: 3 ~~Transect:~~

Plot:

Date: 6-22-93

DATA -- VEGETATION	Stratum and Species (DOMINANTS ONLY)	Dominance Ratio	Percent Dominance	NWI Status
Tree				
	Acer rubrum	1017.52/1056.78	96	FAC

Note: use asterisk * to indicate FAC-, FACU, or UPL species with observed adaptions to wetland hydrology

TALLY (Dominants ONLY)

OBL	FACW	FAC	*FAC-	*FACU	*UPL	FAC-	FACU	UPL

SUBTOTAL (HYDROPHYTES): ______ SUBTOTAL: 1

TOTAL: ______

100 × SUBTOTAL (HYDROPHYTES) / TOTAL = ______ = PERCENT HYDROPHYTES

DESCRIBE VEGETATION DISTURBANCE:

DESCRIBE ADAPTATIONS:

DATA -- SOIL

Soil Taxonomy: Histic Humaquept

Corps of Engineers Regional Drainage Class: very poorly drained Criterion: A3

Is Published Soil Survey Available? Yes ☒ No ☐ Title/Date: Middlesex County 1991

Soil Type Mapped: Scarboro

Field Observations Confirm Type Mapped? Yes ☒ No ☐

Depth	Horizon	Matrix Color (Munsell, Moist)	Color of Mottles (Munsell, Moist) Abundance/Contrast	USDA Texture, Iron or manganese nodules or concretions, restrictive layers, root distribution, oxidized rhizospheres, etc.
0-2				roots
2-10		7.5YR 2/0	none	muck
>10		7.5YR 2/0	none	muck

Remarks:

Sketch Landscape Position:

FOR USE WITH 1987 CORPS WETLANDS DELINEATION MANUAL

SOIL DETERMINATION

NOTE:
1. "NO" to all the following is evidence that the soil IS NOT HYDRIC
2. This checklist is valid for use by the New England Corps of Engineers; use outside the six New England States may be inappropriate
3. This interpretive routine may be inappropriate in unusual cases

Yes	No	
[ ]	[X]	Soil is frequently PONDED or FLOODED for a duration longer than two weeks during the growing season. (attach an explanation of the basis for your conclusions)
[X]	[ ]	The soil meets the Corps of Engineers regional criteria as a VERY POORLY DRAINED SOIL* and there is no evidence of altered hydrology
[ ]	[X]	The soil meets the Corps of Engineers regional criteria as a POORLY DRAINED SOIL and there is no evidence of altered hydrology
[ ]	[X]	The soil meets the Corps of Engineers regional criteria as a SOMEWHAT POORLY DRAINED SOIL that has either of the following two characteristics*:

Yes [ ] No [ ] 1. Within 8 inches of the soil surface there are:

- Yes [ ] No [ ] a. soil mottles within an A or Ap horizon and the subsoil is mottled throughout; OR
- [ ] [ ] b. common to many, distinct or prominent mottles with a matrix of chroma 3 or less; OR
- [ ] [ ] c. distinct or prominent oxidized rhizospheres and the subsoil is mottled throughout.

[ ] [ ] 2. Within 24 inches of the soil surface, there are mottles which are common to many, distinct or prominent, and that are chroma 2 or less, and one of the following:

- Yes [ ] No [ ] a. In the horizon that lies within 10 inches of the soil surface and directly beneath a dark** A or Ap horizon, the matrix is chroma 3 or less; the mottles are at least 10% in abundance and distinct or prominent.
- [ ] [ ] b. When a dark** Ap horizon is between 10 and 14 inches thick, wetness morphology may be masked by organic matter. Normally, these problem situations will be considered hydric when: i. hydrophytes are prevalent, ii. there is no evidence of altered hydrology, and iii. in the horizon that lies directly beneath the Ap horizon, the matrix color is chroma 3 or less and mottles are at least 10% in abundance and distinct or prominent.

[ ] Check here and attach a description of your procedures and conclusions if one of the following options were chosen for your hydric soil determination: measured redox potentials, colormetric test for ferrous iron test (α,α,-Dipyridil), or other measurements and observations.

* Typically in New England, soils having these morphologies will be classified in an aquic suborder or an aquic subgroup in soil taxonomy

** Note: a dark A or Ap is defined as having a value of 3 or less and a chroma of 2 or less

Remarks:

DATA & DETERMINATION HYDROLOGY

NOTE
1. Hydrology is often the most difficult feature to observe
2. Interpretations must consider the appropriateness of the observations in light of the season, recent weather conditions, and watershed alterations, etc
3. Interpretation of hydrology may require repeated observations over more than one season

[ ] Recorded Data
- Stream, lake or tidal gage — Identification
- Aerial Photograph — Identification
- Other — Identification

[ ] No Recorded Data Available

REPORT ANY OF THE FOLLOWING OBSERVATIONS

Depth to Free Water: 10"

Depth to Saturation: 3"

Describe Altered Hydrology:

- [ ] Inundated
- [X] Saturated in upper 12 inches
- [X] Water Marks
- [ ] Drift Lines
- [ ] Sediment Deposits
- [ ] Drainage Patterns within Wetlands

Remarks: water stained leaves
adventitious roots
shallow root systems

CONCLUSIONS

Project Title

Delineator:

Transect   Plot: Date:

	Yes	No
Greater than 50 Percent Hydrophytes?	[ ]	[ ]
Hydric Soils Criterion Met?	[X]	[ ]
Wetland Hydrology Present?	[X]	[ ]

IS THIS DATAPOINT WITHIN A WETLAND? Yes [ ] No [ ]

Remarks

Key

L Low
M Moderate
H High
U Unfavorable
A Absent
P Perennial
E Ephemeral

WETLAND INVENTORY DATA

Project No. P11/P13
Wetland No. Cover type 3

ECOLOGICAL ELEMENTS

Wetland Subclasses
- Stream or Brookside Wetland
- Open Fresh Water
  - Non-vegetated Subclass
- Deep Fresh Marsh
  - Dead Woody / Shrub
  - Scrub-Shrub / Robust
  - Narrow-leaved / Broad-leaved
- Shallow Fresh Marsh
  - Robust / Narrow-leaved
  - Broad-leaved / Floating-leaved
- Floodplain/Flats
  - Emergent
  - Shrubs and Trees
- Wet Meadow
  - Ungrazed / Grazed
- Shrub Swamp
  - Sapling / Bushy
  - Compact / Aquatic
- Wooded Swamp
  - Deciduous / Evergreen
- Bog
  - Shrub / Wooded
  - Cranberry / Moss
- Fen
  - Emergent / Shrub

Dominant Wetland Class
- Stream or Brookside Wetland
- Open Fresh Water
- Deep Fresh Marsh
- Shallow Fresh Marsh
- Yearly Floodplain
- Wet Meadow
- Shrub Swamp
- Wooded Swamp
- Bog
- Fen
- Other ____

Wetland Class Richness
>5 / 4 / 3 / 2 / 1

Subclass Richness (Lateral Diversity)
>10 / 9-6 / 5-4 / 3-2 / 1

Vegetative Interspersion
H / M / L

Surrounding Habitat
- >90% of 2 or more listed types
- 50-90% of 1 or more; 90% of 1
- <50% of 1 or more of listed types

Cover Type
- 26-75% scattered
- 26-75% peripheral
- >75% or <25% scattered
- 100% cover; >75% or <25% peripheral

Percent Open Water
0-33% / 34-66% / 67-95% / 96-100%

Vegetative Species Richness
H / M / L

Proportion of Wildlife Food Plants
H / M / L

Vegetative Density
H / M / L

Wetland Juxtaposition Favorability
H / M / U

TOPOGRAPHICAL ELEMENTS

Topographic Configuration
- Closed Basin
- Semi-closed Basin
- Valley
- Hillside

Size
- Large ≥4.6 acres
- Medium 1.1-4.5
- Small ≤1 acre

Wetland Gradient
Slight 0-3% / Steep >3%

Surrounding Slopes
Slight 0-3% / Steep >3%

Topographic Position in Watershed
Upper / Intermediate / Lower

GEOLOGICAL ELEMENTS

Surficial Geologic Material Underlying Wetland
- Till / Alluvium
- Stratified Sand and Gravel
- Stratified Fine Sand and Silt

Bedrock Underlying Wetland
- Igneous and Metamorphic
- Sedimentary

Soil Type/Permeability
Peat/H / Mineral/M / Muck/L

Dominant Surficial Geological Material of Watershed
- Till / Alluvium
- Stratified Sand and Gravel
- Stratified Fine Sand and Silt

Thickness of Organics
<1 foot / >1-5 feet / >5 feet

SPECIAL ELEMENTS

- Rare and/or Endangered Species
- Aquatic Study Area
- Sanctuary or Refuge
- Wildlife Management Area
- Fisheries Management Area
- Educational Study Area
- Historical Area
- Other ____

HYDROLOGICAL ELEMENTS

Hydrologic Position of Wetland
- Perched Wetland
- Water Table Wetland
- Water/Artesian Wetland
- Artesian Wetland

Groundwater Relationship
- Discharge Wetland
- Recharge Wetland
- Combination

Transmissivity of Aquifer
- Low <10,000 gal/day/ft
- Moderate 10,000 - 40,000 gal/day/ft
- High >40,000 gal/day/ft

Dominant Hydrologic Condition
1 / 2 / 3 / 4 / 5 / 6

Connection by Surface Water to a Riparian System
Yes / No

Watershed Land Use
- Rural
- Rural/Residential
- Urban
- Industrial
- Other ____

Water Level Fluctuation
H / L / Vernal Pool

Groundwater Outflow From Wetland
Absent / Present

Inlet
A / P / E
Present, to wetland ____

Inlet
A / P / E
Present, to wetland ____

Inlet
A / P / E
Present, to wetland ____

Inlet
A / P / E
Present, to wetland ____

Inlet
A / P / E
Present, to wetland ____

Outlet
A / P / E
Present, to wetland ____

Outlet
A / P / E
Present, to wetland ____

Percent Wetlands Bordering Open Water vs. Upland
<33% / 39-66% / 67-100%
Does not border

Fetch
>2000 ft. / <2000 ft.

Depth of Lake
Deep >6 ft. / Shallow <6 ft.

SOCIO-ECONOMICAL ELEMENTS

Hydrologically Connected to a
- Small stream
- River
- Lake
- Combination
- Not connected

Public Access to Wetland
- Within 100 ft. of road
- Access by passable waterway
- Isolated

Surrounding Population Density
- <½ person/acre (<320/mi²)
- 0.5 - 1.9 p/a (320-1220/mi²)
- >2 p/a (>1220/mi²)

Local Scarcity to Nearest Similar Type
- <200 feet
- 201 to 1000 feet
- >1000 feet

Known Crop Value or Potential
- None
- Supports 1 family for part of year
  Type ____
- Supports viable commercial interest
  Type ____

Legal Accessibility to Wetland
Public / Private / Restricted

Cultural Significance
Archeological/Historic / None

...ts	Element Weight	Condition Weight	Conditions	
Fisheries[a]	NA[b]	NA	Present	
		NA	Not Present	
...ce of ...ered or ...tened Species[a]	NA	NA	Present	
		NA	Not Present	
...ant Wetland	5	1	Stream or Brookside wetland	
		0	Open fresh water	
		4	Deep fresh marsh(aquatic bed)	
		5	Shallow fresh marsh	
		5	Yearly flooded floodplain	
		2	Wet meadow	10
		4	Shrub swamp	
		2	Wooded swamp (deciduous)	
		4	Wooded swamp (coniferous)	
		3	Bog	
...r of Wetland ...es (Richness)	4	5	≥6	
		4	4	
		3	3	16
		2	2	
		1	1	
...er of Wetland ...lasses (Richness)	3	5	>10	
		4	6-9	
		3	4-5	9
		2	2-3	
		1	1	
Vegetative ~~...ative~~ ...evaporation Interspersion	4	3	High	
		2	Moderate	8
		1	Low	
...rounding Habitat	3	3	>90% of two or more of listed types	
		2	50-90% of one or more 90% of one	6
		1	<50% of one or more listed	
...er/Cover Ratio ...ver Typed)	3	4	26-75% scattered	
		2	26-75% peripheral	
		3	75% or <25% scattered	3
		1	100% cover:>75% or 25% peripheral	
...ber of Plant ...cies (Vegetative ...cies Richness)	2	1	Low	
		2	Medium	4
		3	High	
...portion of ...dlife Food Plants	1	1	Low	
		2	Moderate	2
		3	High	
...etative Density	2	3	High	
		2	Moderate	6
		1	Low	
...tland Juxtaposition	3	3	Highly favorable	
		2	Moderately favorable	6
		0	Unfavorable	
...drological Position ...roundwater ...nnection)	2	1	Perched wetland	
		4	Water table wetland	
		3	Water table/artesian wetland	8
		3	Artesian wetland	
...ter Level ...uctuation	1	2	Low	
		1	Vernal pool	2
		0	High	

Elements	Element Weight	Condition Weight	Conditions	
Surface Water	1	1	Connected to a small stream	
		2	Connected to a river	
		3	Connected to a lake	1
		4	Connected to a combination	
		0	Not connected	
Percent Wetland Bordering on Open water	4	1	<33%	
		2	34-66%	4
		3	67-100%	
		0	Does not border	
Size	5	3	Large ≥ 4.6 acres	
		2	Medium 1.1-4.5 acres	15
		1	Small ≤ 1.0 acres	
		Range 29-158 Mean 93		

a-preemptive factors
b-not applicable

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Figure 10. Hydrologic Support Function Model

Elements	Element Weight	Condition Weight	Conditions	
Size	4	3	Large ≥ 4.6 acres	
		2	Moderate 1.1-4.5 acres	12
		1	Small ≤ 1.0 acres	
Topographic Configuration	1	3	Semi-closed basin	
		2	Valley	
		1	Hillside	3
		0	Closed Basin	
Dominant Hydrologic Type	5	1	Condition 1	
		2	Condition 2	
		3	Condition 3	25
		4	Condition 4	
		5	Condition 5	
		0	Condition 6	
Water Level Fluctuation	2	2	Low	4
		1	High	
Outlet	4	2	Perennial Outlet	
		1	Ephemeral Outlet	8
		1	Groundwater Outflow	
		0	Absent	
Inlet	1	2	Perennial	
		1	Ephemeral	2
		0	Absent	
Percent Wetland[a] Bordering on Open Water	4	1	<33%	
		2	34-66%	4
		3	67-100%	
		0	Does not border	
		Range 6-70[b] Mean 36		58

a Applies only to those wetlands with an outlet
b Total value for one inlet and one outlet only.

Elements	Element Weight	Condition Weight	Conditions
Surficial Geology	3	1	Till
	6	4	Stratified sand and gravel
		3	Stratified fine sand and silt
		2	Alluvium
Organic Material	2	3	Absent
	2	2	High permeability
		1	Low permeability
Hydrologic Position	5	2	Perched wetland
		4	Water table wetland
	20	2	Water table/artesian wetland
		1	Artesian wetland
Transmissivity of Aquifer	4	1	Low <10,000 gal/day/ft
	4	2	Med. 10,000-40,000 gal/day/ft
		3	High >40,000 gal/day/ft
Inlet	1	1	Absent
	2	3	Perennial
		2	Ephemeral
Outlet	2	3	Absent
	4	2	Perennial
		1	Ephemeral
Size	3	3	Large ≤ 4.6 acres
	9	2	Medium 1.1-4.5 acres
	47	1	Small ≥ 1.0 acres
		Range 20-68* Mean 44	

* Total value for one inlet and one outlet only. Some wetlands may have more than one inlet or outlet but the range above is for wetlands with only one inlet and one outlet.

Figure 12. Storm and Flood Water Storage Function Model

Elements	Element Weight	Condition Weight	Conditions
Dominant Wetland Class	2	1	Stream or brookside wetland
		1	Open fresh water
		2	Deep fresh marsh (aquatic bed)
	8	4	Shallow fresh marsh
		4	Yearly flooded floodplain
		3	Wet meadow
		5	Shrub swamp
		4	Wooded swamp
		3	Bog
Percent Open Water	2	3	0-33%
		2	34-66%
	6	1	67-95%
		0	96-100%
Vegetative Density	4	3	High
	12	2	Moderate
		1	Low
Topographic Configuration	2	4	Closed Basin
	6	3	Semi-closed basin
		2	Valley
		1	Hillside
Topographic Position in Watershed	3	3	Upper
	3	2	Intermediate
		1	Lower

Elements	Element Weight	Condition Weight	Conditions
Surficial Material of Watershed	2	4	Till
		1	Stratified sand and gravel
	4	3	Stratified fine sand and silt
		2	Alluvium
Surficial Geologic Material of Wetland Banks	2	1	Till
		4	Stratified sand and gravel
	6	2	Stratified find sand and silt
		3	Alluvium
Organic Material	1	2	High permeability
	1	1	Low permeability
		0	Absent
Dominant Hydrologic Type	5	1	Condition 1
		2	Condition 2
		3	Condition 3
	25	4	Condition 4
		5	Condition 5
		6	Condition 6
Hydrologic Connection	4	1	Not part of riparian system
	8	2	Part of riparian system
Water Level Fluctuation	3	2	High
	3	1	Low
Inlet	1	2	Perennial
	2	1	Ephemeral
		0	Absent
Outlet	1	1	Perrennial
	1	2	Ephemeral
		0	Absent
Size	4	3	Large ≥ 4.6 acres
	12	2	Medium 1.1-4.5 acres
		1	Small ≤ 1.0 acres
	97	Range 31-123 Mean 77	

*Total value for one inlet and one outlet only. Some wetlands may have more than one inlet or outlet but the range above is for wetlands with only one inlet and one outlet.

Element	Element Weight	Condition Weight	Condition
Wetland Borders[a] Lake or Stream	NA[b]	NA	Yes
		NA	No
Vegetative Density	3	0	Open fresh water
		0	Stream and brookside
		1	Deep fresh marsh (aquatic bed)
		2	Shallow fresh marsh
		4	Yearly floodplan
		1	Wet meadow
		4	Shrub swamp
		4	Wood swamp
		3	Bog
Surficial Material Underlying Wetland	1	2	Till
		1	Stratified sand and gravel
		4	Stratified find sand and silt
		3	Alluvium
Fetch (Lakes only)	4	2	Over 2000 ft.
		1	Under 2000 ft.
Depth of Lake	1	2	Deep 6 ft.
		1	Shallow 6 ft.
		Range 3-32 Mean 17	

[a]preemtive
[b]not applicable

Elements	Element Weight		Condition Weight	Conditions
Dominant Hydrologic Type	4		1	Condition 1
			2	Condition 2
		20	3	Condition 3
			4	Condition 4
			5	Condition 5
			6	Condition 6
Hydrologic Connection	2	4	1	Not part of the riparian sy
			2	Part of riparian system
Inlet	2	4	2	Perennial
			1	Ephemeral
			0	Absent
Outlet	3	6	2	Perennial
			1	Ephemeral
			0	Absent
Size	4	12	3	Large ≥ 4.6 acres
			2	Moderate 1.1-4.5 acres
			1	Small ≤ 1.0 acres
		83	Range 18-98[a] Mean 58	

[a]Total value for one inlet and one outlet only. Some wetlands may have more than one inlet or outlet but the range above is onl for wetlanes with one inlet and one outlet.

Figure 14. Water Quality Maintenance Function Model

Elements	Element Weight		Condition Weight	Conditions
Dominant Wetland Class	4		1	Stream or brookside wetland
			0	Open fresh water
			3	Deep fresh marsh (aquatic bed)
		8	4	Shallow fresh marsh
			4	Yearly floodplain
			3	Wet meadow
			4	Shrub Swamp
			2	Wooded swamp
			2	Bog
Percent open water	1		3	0-33%
			2	34-66%
		3	1	67-95%
			0	96-100%
Vegetative Density	3		3	High
		9	2	Moderate
			1	Low
Topographic Configuration	3		4	Closed Basin
			3	Semi-closed basin
		9	2	Valley
			1	Hillside
Topographic Position in Watershed	2		1	Upper
		6	2	Intermediate
			3	Lower
Organic Material	1		1	High permeability
		2	2	Low permeability
			0	Absent

Figure 15. Cultural and Economic Function Model

Elements	Element Weight		Condition Weight	Conditions
Dominant Wetland Class	4		0	Stream of brookside
			0	Open fresh water
			4	Deep fresh marsh
		20	4	Shallow fresh marsh
			0	Yearly flooded floodplain
			2	Wet meadow
			3	Shrub swamp
			5	Wooded swamp (deciduous)
			6	Wooded swamp (coniferous)
			3	Bog
Access	3		3	Within 100' of road
		9	2	Access by passable waterwa
			1	Isolated
Size	8		3	Large ≥ 4.6 acres
		24	2	Medium 1.1-4.5 acres
			1	Small ≤ 1.0 acres
		53	Range 11 Mean 34	

Figure 16. Recreational Function Model

Elements	Element Weight	Condition Weight	Conditions
Dominant Wetland Class	3	0	Stream or brookside
		0	Open fresh water
		6	Deep fresh marsh
	6	5	Shallow fresh marsh
		0	Yearly flooded floodplain
		0	Wet meadow
		2	Shrub swamp
		2	Wooded swamp (deciduous)
		3	Wooded swamp (coniferous)
		2	Bog
Percent Open Water	3	1	0-33%
	3	2	34-66%
		3	67-95%
		0	96-100%
Surface Water Association	4	1	Connected to a small stream
	4	2	Connected to a river
		3	Connected to a lake
		4	Connected to a combination
		0	Not connected
Access to Public	2	3	Within 100' of road
	6	2	Access by passable waterway
		1	Isolated
Size	4	3	Large ≥ 4.6 acres
	12	2	Medium 1.1-4.5 acres
		1	Small ≤ 1.0 acres
Legal Access	2	2	Yes
	2	1	No
Output From Biological Function	3	3	High 116-158
	6	2	Moderate 73-115
		1	Low 29-72
		Range 11-74 Mean 42	
	39		

Figure 17. Aesthetic Function Model

Elements	Element Weight	Condition Weight	Conditions
Dominant Wetland Class	4	0	Stream or brookside wetland
		0	Open fresh water
		5	Deep fresh marsh
		4	Shallow fresh marsh
	12	0	Yearly flooded floodplain
		0	Wet meadow
		2	Shrub swamp
		3	Wooded swamp (deciduous)
		3	Wooded swamp (coniferous)
		5	Bog
Number of Subclasses (Richness)	3	4	6-9
	6	2	2-3
		1	1
Percent Open Water	4	1	0-33%
		3	34-66%
	4	4	67-95%
		0	96-100%
Access to Public	3	3	Within 100 ft. of road
	9	2	Access by passable waterway
		1	Isolated
Local Scarcity	3	1	<200 ft. to nearest similar type
	6	2	201-1000 ft to nearest similar type
		3	>1000 ft. to nearest Similar type
		Range 9-66 Mean 37	
	37		

Figure 18. Educational Function Model

Elements	Element Weight	Condition Weight	Conditions
Subclass Richness (Lateral Diversity)	3	4	6-9
		3	4-5
	9	2	2-3
		1	1
Access to Public	4	3	Within 100' of road
	12	2	Access by passable waterway
		1	Isolated
	21	Range 7-24 Mean 15	

COVER TYPE DESCRIPTION FORM

Project: Sudbury Annex, P11 & 13
Field Crew: Vangalio, Kim, Azzopardi

Date: 6-22
Photo #(s): 4-3

Cover Type No.: 4
Cover Type Name: Aspen forest

VEGETATION: (* = dominants)

Trees (DBH= veg. density= 60
quaking aspen*, red oak, white pine, shagbark hickory

Saplings/shrubs (veg. density= 60):
white pine, s. hickory, red oak
red maple, flowering dogwood

Woody Vines (veg. density= 30):
poison ivy, Virginia creeper, rubus spp.

Herbs (veg. density= 10):
asters, goldenrods
grasses

Comments (diversity, quality, exotics):

SOIL COMPOSITION: 7.5 YR 3/2

SLOPE: 13-15 %

HYDROLOGY: absent

WATER BODIES: adjacent to intermittent stream

WILDLIFE:

Species Observed:

Other Evidence of Wildlife Use:

Wildlife Values:

___ travel corridors
✓ abundance of cover
✓ abundance of food
✓ abundance of edge
___ cavity trees
___ standing dead snags
___ large, contiguous fore

Available Wildlife Foods:
acorns, nuts, catkins & seeds, berries

DISTURBANCE: (fire, logging, ditching, stressed veg., stained soils, drums
• adjacent to road

BASAL AREA FIELD FORM

Project: Sudbury Annex, P11 & 13
Cover type number: 4
Plot radius: ~30'

Date: 6-22
Crew: Vangalio, Azzopardi, Kim

			SPECIES					
DBH(in.)	Midpt.	BA/tree	quaking aspen	red oak	white pine	shagbark hickory		
4-6	5	19.63	𝍸 ||	|		|		
6-8	7	38.47	|					
8-10	9	63.59	|	|	|			
10-12	11	94.99	|		|			
12-14	13	132.67						
14-16	15	176.63						
16-18	17	226.87						
18-20	19	283.39						
20-22	21	346.19						
22-24	23	415.27						
24-26	25	490.63						
26-28	27	572.27						
28-30	29	660.19						
30-32	31	754.39						
32-34	33	854.87						
34-36	35	961.63						
Total BA/species			334.46	83.22	158.58	19.63		
Total BA/plot			595.89 →					
Relative dominance (%)			56	14	27	3		

FOR USE WITH 1987 CORPS WETLANDS DELINEATION MANUAL

Project Title: Sudburry P11 P13 | File Number:

~~Transect~~ Covertype 4 | Plot: | Date: 6-22-93

DATA -- VEGETATION	Stratum and Species (DOMINANTS ONLY)	Dominance Ratio	Percent Dominance	NWI Status
Tree				
	Populus tremuloides	334.46 / 595.89	56	FACU

Note: use asterisk * to indicate FAC-, FACU, or UPL species with observed adaptions to wetland hydrology

TALLY (Dominants ONLY)

OBL	FACW	FAC	*FAC-	*FACU	*UPL	FAC-	FACU	UPL

SUBTOTAL (HYDROPHYTES): ______ SUBTOTAL: ______

TOTAL ______

100 x SUBTOTAL (HYDROPHYTES) / TOTAL = ______ = PERCENT HYDROPHYTES

DESCRIBE VEGETATION DISTURBANCE:

DESCRIBE ADAPTATIONS

DATA -- SOIL | Soil Taxonomy:

Corps of Engineers Regional Drainage Class: | Criterion:

Is Published Soil Survey Available? Yes ☒ No ☐ Title/Date: Middlesex County 1991

Soil Type Mapped: Carver | Field Observations Confirm Type Mapped? Yes ☐ No ☐

Depth	Horizon	Matrix Color (Munsell, Moist)	Color of Mottles (Munsell, Moist) Abundance/Contrast	USDA Texture, Iron or manganese nodules or concretions, restrictive layers, root distribution, oxidized rhizospheres, etc.
0-1				
1-10		7.5YR 3/3	none	sandy loam
10-18		7.5YR 3/2	none	sandy loam

Remarks:

Sketch Landscape Position:

FOR USE WITH 1987 CORPS WETLANDS DELINEATION MANUAL

SOIL DETERMINATION

NOTE:
1. "NO" to all the following is evidence that the soil is NOT HYDRIC
2. This checklist is valid for use by the New England Corps of Engineers; use outside the six New England States may be inappropriate
3. This interpretive routine may be inappropriate in unusual cases

Yes	No	
☐	☐	Soil is frequently PONDED or FLOODED for a duration longer than two weeks during the growing season (attach an explanation of the basis for your conclusions)
☐	☐	The soil meets the Corps of Engineers regional criteria as a VERY POORLY DRAINED SOIL* and there is no evidence of altered hydrology
☐	☐	The soil meets the Corps of Engineers regional criteria as a POORLY DRAINED SOIL* and there is no evidence of altered hydrology
☐	☐	The soil meets the Corps of Engineers regional criteria as a SOMEWHAT POORLY DRAINED SOIL that has either of the following two characteristics*:

Yes ☐ NO ☐ — 1. Within 8 inches of the soil surface there are:

- Yes ☐ No ☐ a. soil mottles within an A or Ap horizon and the subsoil is mottled throughout; OR
- ☐ ☐ b. common to many, distinct or prominent mottles with a matrix of chrome 3 or less; OR
- ☐ ☐ c. distinct or prominent oxidized rhizospheres and the subsoil is mottled throughout

☐ ☐ — 2. Within 24 inches of the soil surface, there are mottles which are common to many, distinct or prominent, and that are chroma 2 or less, and one of the following:

- Yes ☐ No ☐ a. In the horizon that lies within 10 inches of the soil surface and directly beneath a dark** A or Ap horizon, the matrix is chroma 3 or less; the mottles are at least 10% in abundance and distinct or prominent.
- ☐ ☐ b. When a dark** Ap horizon is between 10 and 14 inches thick, wetness morphology may be masked by organic matter. Normally, these problem situations will be considered hydric when: i. hydrophytes are prevalent, ii. there is no evidence of altered hydrology, and iii. in the horizon that lies directly beneath the Ap horizon, the matrix color is chroma 3 or less and mottles are at least 10% in abundance and distinct or prominent.

☐ Check here and attach a description of your procedures and conclusions if one of the following options were chosen for your hydric soil determination: measured redox potentials, colormetric test for ferrous iron test (α,α,-Dipyridil), or other measurements and observations.

* Typically in New England, soils having these morphologies will be classified in an aquic suborder or an aquic subgroup in soil taxonomy.
** Note: a dark A or Ap is defined as having a value of 3 or less and a chroma of 2 or less

Remarks:

DATA & DETERMINATION HYDROLOGY

NOTE
1. Hydrology is often the most difficult feature to observe
2. Interpretations must consider the appropriateness of the observations in light of the season, recent weather conditions, and watershed alterations, etc
3. Interpretation of hydrology may require repeated observations over more than one season

☐ Recorded Data
- Stream, lake or tidal gage — Identification ______
- Aerial Photograph — Identification ______
- Other — Identification ______

☐ No Recorded Data Available

REPORT ANY OF THE FOLLOWING OBSERVATIONS:

Depth to Free Water: >18"

Depth to Saturation: >18"

Describe Altered Hydrology: ______

- ☐ Inundated
- ☐ Saturated in upper 12 inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns within Wetlands

Remarks

CONCLUSIONS

Project Title: ______

Delineator: ______

Transect: ______ Plot: ______ Date: ______

	Yes	No
Greater than 50 Percent Hydrophytes?	☐	☐
Hydric Soils Criterion Met?	☐	☒
Wetland Hydrology Present?	☐	☒
IS THIS DATAPOINT WITHIN A WETLAND?	☐	☐

Remarks

COVER TYPE DESCRIPTION FORM

Project: Sudbury Annex, P11 & 13
Field Crew: Azzopardi, Kim, Vangalio

Date: 6-23
Photo #(s): 4-5

Cover Type No.: 5
Cover Type Name: Red maple forest

VEGETATION: (* = dominants)

Trees (DBH= veg. density= 85
red maple* white pine red cedar slippery elm
red oak black cherry white ash

Saplings/shrubs (veg. density= 10):
red maple silky dogwood
red oak

Woody Vines (veg. density= 90):
poison ivy*

Herbs (veg. density= 2):
grasses, goldenrods

Comments (diversity, quality, exotics):
• very dense and immature

SOIL COMPOSITION: 7.5 YR 3/2

SLOPE: 0-3 %

HYDROLOGY: absent

WATER BODIES: adjacent to PFO drainages

WILDLIFE:

Species Observed:
turkey (heard)

Other Evidence of Wildlife Use:

Wildlife Values:

	travel corridors
✓	abundance of cover
	abundance of food
✓	abundance of edge
	cavity trees
	standing dead snags
	large, contiguous fore:

Available Wildlife Foods:
seeds, pine cones

DISTURBANCE: (fire, logging, ditching, stressed veg., stained soils, drums

• near fence and roads

BASAL AREA FIELD FORM

Project: Sudbury Annex, P11 & 13
Cover type number: 5
Plot radius: ~30'

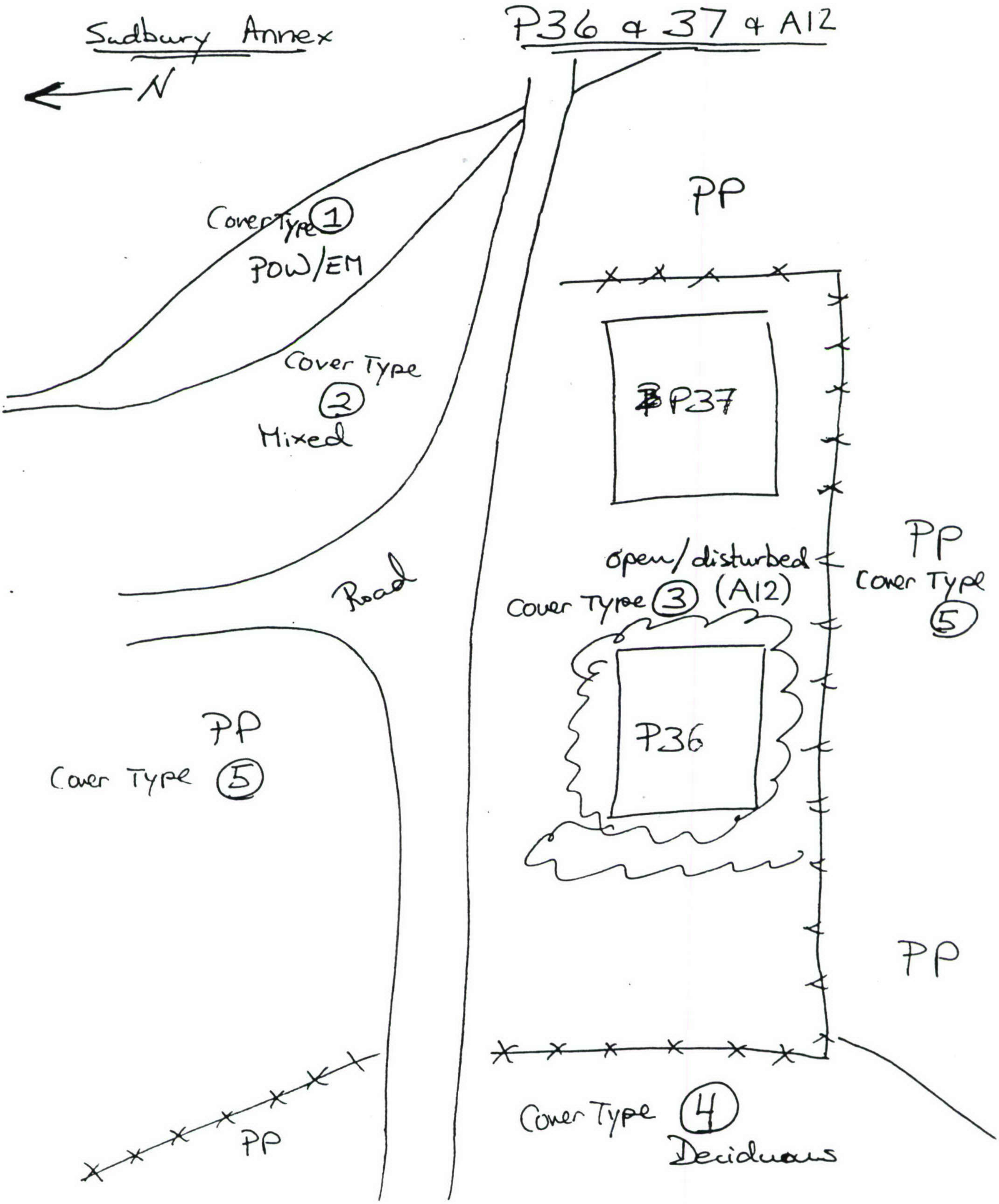
Date: 6-23
Crew: Azzopardi, Kim, Vangalio

DBH(in.)	Midpt.	BA/tree	red maple	red oak	SPECIES white ash	red cedar	black cherry	slippery elm	whit[e] pin[e]
4-6	5	19.63	~~||||~~ |		|		|		
6-8	7	38.47	|||			|		|	
8-10	9	63.59	||		|				
10-12	11	94.99	|						
12-14	13	132.67					|		
14-16	15	176.63		|					|
16-18	17	226.87							
18-20	19	283.39							
20-22	21	346.19							
22-24	23	415.27							
24-26	25	490.63							
26-28	27	572.27							
28-30	29	660.19							
30-32	31	754.39							
32-34	33	854.87							
34-36	35	961.63							
Total BA/species			455.36	176.63	83.22	38.47	152.30	38.47	176.[6]
Total BA/plot			1121.08 →						
Relative dominance (%)			41	16	8	3	13	3	16

CONTENTS

RI SITE ENCOMPASSING A12, P36, AND P37

- Field map;
- For each cover type (5 total)
  - Cover type description form
  - Basal area field form
  - United States Corps of Engineers Wetland forms (only for cover types 1 and 2).
- For each wetland (1 total)
  - United States Fish and Wildlife Service Wetlands Functions Evaluation forms



Sudbury Annex
P36 & 37 & A12
N
PP
Cover Type 1
POW/EM
Cover Type 2
Mixed
P37
open/disturbed
PP
Cover Type 5
Road
Cover Type 3 (A12)
P36
PP
Cover Type 5
PP
PP
Cover Type 4
Deciduous

COVER TYPE DESCRIPTION FORM

Project: Sudbury Annex, P36 & 37
Field Crew: Vangalio, Kim, Azzopardi

Date: 6-21
Photo #(s): 3-15

Cover Type No.: 1
Cover Type Name: Open water wetland (POW)

VEGETATION: (* = dominants)

Trees (DBH= veg. density= 1%
hemlock (scattered)

Saplings/shrubs (veg. density= 5%):
speckled alder, red maple

Woody Vines (veg. density= 0):
none

Herbs (veg. density= 50):
jewelweed, water lily (yellow), sensitive fern, sedges, slender-leaved iri
boneset, cattails, skunk cabbage, rushes

Comments (diversity, quality, exotics):
- vegetation is concentrated around the edges
- dead snags in water
- cattails are concentrated in northern end

SLOPE: 0

SOIL COMPOSITION: muck

HYDROLOGY: open water

WATER BODIES: 60% open water: pond formed at widening of Marlboro Brook

WILDLIFE:

Species Observed:
painted turtle

Other Evidence of Wildlife Use:

Wildlife Values:
- ____ travel corridors
- ____ abundance of cover
- ____ abundance of food
- ____ abundance of edge
- ____ cavity trees
- ✓ standing dead snags
- ____ large, contiguous fore

Available Wildlife Foods:

DISTURBANCE: (fire, logging, ditching, stressed veg., stained soils, drums

- south end of pond has been culverted

BASAL AREA FIELD FORM

Project: Sudbury Annex, P36 & 37
Cover type number: 1
Plot radius: ~30'

Date: 6-21
Crew: Kim, Vangalio, Azzopardi

DBH(in.)	Midpt.	BA/tree			SPECIES			
4-6	5	19.63						
6-8	7	38.47						
8-10	9	63.59						
10-12	11	94.99						
12-14	13	132.67						
14-16	15	176.63						
16-18	17	226.87						
18-20	19	283.39		No	Trees	(not	in	plot)
20-22	21	346.19						
22-24	23	415.27						
24-26	25	490.63						
26-28	27	572.27						
28-30	29	660.19						
30-32	31	754.39						
32-34	33	854.87						
34-36	35	961.63						
Total BA/species								
Total BA/plot								
Relative dominance (%)								

FOR USE WITH 1987 CORPS WETLANDS DELINEATION MANUAL

Project Title: Sudburry P36 P37 File Number:

Cover type 1 ~~Transect~~ Plot: Date: 6-21-93

DATA -- VEGETATION	Stratum and Species (DOMINANTS ONLY)	Dominance Ratio	Percent Dominance	NWI Status
Tree				
none				

Note: use asterisk * to indicate FAC-, FACU, or UPL species with observed adaptions to wetland hydrology

TALLY (Dominants ONLY)

OBL	FACW	FAC	*FAC-	*FACU	*UPL	FAC-	FACU	UPL
___	___	___	___	___	___	___	___	___

SUBTOTAL (HYDROPHYTES): ______ SUBTOTAL: 1

TOTAL: ______

$\frac{100 \times \text{SUBTOTAL (HYDROPHYTES)}}{\text{TOTAL}}$ = ______ = PERCENT HYDROPHYTES

DESCRIBE VEGETATION DISTURBANCE

DESCRIBE ADAPTATIONS

DATA -- SOIL Soil Taxonomy: Typic Medisaprist

Corps of Engineers Regional Drainage Class: very poorly drained Criterion: A3

Is Published Soil Survey Available? Yes ☒ No ☐ Title/Date: Middlesex County 1991

Soil Type Mapped: Montauk * Field Observations Confirm Type Mapped? Yes ☐ No ☒

Depth	Horizon	Matrix Color (Munsell, Moist)	Color of Mottles (Munsell, Moist) Abundance/Contrast	USDA Texture, iron or manganese nodules or concretions, restrictive layers, root distribution, oxidized rhizospheres, etc.
<18"		7.5YR2/0		muck

Remarks: * resembles Freetown muck which occurs at nearby stream

Sketch Landscape Position:

FOR USE WITH 1987 CORPS WETLANDS DELINEATION MANUAL

SOIL DETERMINATION

NOTE:
1. "NO" to all the following is evidence that the soil is NOT HYDRIC
2. This checklist is valid for use by the New England Corps of Engineers; use outside the six New England States may be inappropriate
3. This interpretive routine may be inappropriate in unusual cases

Yes	No	
☐	☒	Soil is frequently PONDED or FLOODED for a duration longer than two weeks during the growing season (attach an explanation of the basis for your conclusions)
☒	☐	The soil meets the Corps of Engineers regional criteria as a VERY POORLY DRAINED SOIL* and there is no evidence of altered hydrology
☐	☒	The soil meets the Corps of Engineers regional criteria as a POORLY DRAINED SOIL* and there is no evidence of altered hydrology
☐	☒	The soil meets the Corps of Engineers regional criteria as a SOMEWHAT POORLY DRAINED SOIL that has either of the following two characteristics*:

Yes NO
☐ ☐ 1. Within 8 inches of the soil surface there are:

Yes No
- ☐ ☐ a. soil mottles within an A or Ap horizon and the subsoil is mottled throughout; OR
- ☐ ☐ b. common to many, distinct or prominent mottles with a matrix of chroma 3 or less; OR
- ☐ ☐ c. distinct or prominent oxidized rhizospheres and the subsoil is mottled throughout

☐ ☐ 2. Within 24 inches of the soil surface, there are mottles which are common to many, distinct or prominent, and that are chroma 3 or less, and one of the following:

Yes No
- ☐ ☐ a. In the horizon that lies within 10 inches of the soil surface and directly beneath a dark** A or Ap horizon, the matrix is chroma 3 or less; the mottles are at least 10% in abundance and distinct or prominent.
- ☐ ☐ b. When a dark** Ap horizon is between 10 and 14 inches thick, wetness morphology may be masked by organic matter. Normally, these problem situations will be considered hydric when: i. hydrophytes are prevalent, ii. there is no evidence of altered hydrology, and iii. in the horizon that lies directly beneath the Ap horizon, the matrix color is chroma 3 or less and mottles are at least 10% in abundance and distinct or prominent.

☐ Check here and attach a description of your procedures and conclusions if one of the following options were chosen for your hydric soil determination: measured redox potentials, colormetric test for ferrous iron test (α,α,-Dipyridil), or other measurements and observations.

* Typically in New England, soils having these morphologies will be classified in an aquic suborder or an aquic subgroup in soil taxonomy.
** Note: a dark A or Ap is defined as having a value of 3 or less and a chroma of 2 or less

Remarks:

DATA & DETERMINATION HYDROLOGY

NOTE:
1. Hydrology is often the most difficult feature to observe
2. Interpretations must consider the appropriateness of the observations in light of the season, recent weather conditions, and watershed alterations, etc
3. Interpretation of hydrology may require repeated observations over more than one season

☐ Recorded Data
- Stream, lake or tidal gage — Identification ______
- Aerial Photograph — Identification ______
- Other — Identification ______

☐ No Recorded Data Available

REPORT ANY OF THE FOLLOWING OBSERVATIONS

- Depth to Free Water: 0"
- Depth to Saturation: 0"
- Describe Altered Hydrology: none

- ☒ Inundated
- ☒ Saturated in upper 12 inches
- ☒ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns within Wetlands

Remarks: water stained leaves

CONCLUSIONS

Project Title:

Delineator:

Transect: Plot: Date:

	Yes	No
Greater than 50 Percent Hydrophytes?	☐	☐
Hydric Soils Criterion Met?	☒	☐
Wetland Hydrology Present?	☒	☐

IS THIS DATAPOINT WITHIN A WETLAND? Yes ☐ No ☐

Remarks:

WETLAND INVENTORY DATA

Key

- L Low
- M Moderate
- H High
- U Unfavorable
- A Absent
- P Perennial
- E Ephemeral

Project No. A12/P56/P37

Wetland No. Cover type 1

ECOLOGICAL ELEMENTS

Wetland Subclasses

- [x] Stream or Brookside Wetland
- Open Fresh Water
  - [ ] Non-vegetated Subclass
- Deep Fresh Marsh
  - [ ] Dead Woody
  - [ ] Shrub
  - [ ] Scrub-Shrub
  - [ ] Robust
  - [ ] Narrow-leaved
  - [ ] Broad-leaved
- Shallow Fresh Marsh
  - [ ] Robust
  - [ ] Narrow-leaved
  - [ ] Broad-leaved
  - [ ] Floating-leaved
- Floodplain/Flats
  - [ ] Emergent
  - [ ] Shrubs and Trees
- Wet Meadow
  - [ ] Ungrazed
  - [ ] Grazed
- Shrub Swamp
  - [ ] Sapling
  - [ ] Bushy
  - [ ] Compact
  - [ ] Aquatic
- Wooded Swamp
  - [ ] Deciduous
  - [ ] Evergreen
- Bog
  - [ ] Shrub
  - [ ] Wooded
  - [ ] Cranberry
  - [ ] Moss
- Fen
  - [ ] Emergent
  - [ ] Shrub

Dominant Wetland Class

- [ ] Stream or Brookside Wetland
- [x] Open Fresh Water
- [ ] Deep Fresh Marsh
- [ ] Shallow Fresh Marsh
- [ ] Yearly Floodplain
- [ ] Wet Meadow
- [ ] Shrub Swamp
- [ ] Wooded Swamp
- [ ] Bog
- [ ] Fen
- [ ] Other________________

Wetland Class Richness
[ ] 5 [ ] 4 [ ] 3 [x] 2 [ ] 1

Subclass Richness (Lateral Diversity)
[ ] 10 [ ] 9-6 [ ] 5-4 [x] 3-2 [ ] 1

Vegetative Interspersion
[ ] H [ ] M [x] L

Surrounding Habitat

- [ ] >90% of 2 or more listed types
- [x] 50-90% of 1 or more; 90% of 1
- [ ] <50% of 1 or more of listed types

Cover Type

- [ ] 26-75% scattered
- [x] 26-75% peripheral
- [ ] >75% or <25% scattered
- [ ] 100% cover; >75% or <25% peripheral

Percent Open Water
[ ] 0-33% [ ] 34-66% [x] 67-95% [ ] 96-100%

Vegetative Species Richness
[ ] H [ ] M [x] L

Proportion of Wildlife Food Plants
[ ] H [ ] M [x] L

Vegetative Density
[ ] H [ ] M [x] L

Wetland Juxtaposition Favorability
[ ] H [x] M [ ] U

SPECIAL ELEMENTS

- [ ] Rare and/or Endangered Species
- [ ] Aquatic Study Area
- [ ] Sanctuary or Refuge
- [ ] Wildlife Management Area
- [ ] Fisheries Management Area
- [ ] Educational Study Area
- [ ] Historical Area
- [ ] Other________________

TOPOGRAPHICAL ELEMENTS

Topographic Configuration

- [ ] Closed Basin
- [x] Semi-closed Basin
- [ ] Valley
- [ ] Hillside

Size

- [ ] Large ≥4.6 acres
- [x] Medium 1.1-4.5
- [ ] Small ≤1 acre

Wetland Gradient
[x] Slight 0-3% [ ] Steep >3%

Surrounding Slopes
[ ] Slight 0-3% [x] Steep >3%

Topographic Position in Watershed
[ ] Upper [ ] Intermediate [x] Lower

GEOLOGICAL ELEMENTS

Surficial Geologic Material Underlying Wetland

- [ ] Till
- [x] Alluvium
- [ ] Stratified Sand and Gravel
- [ ] Stratified Fine Sand and Silt

Bedrock Underlying Wetland

- [ ] Igneous and Metamorphic
- [ ] Sedimentary

Soil Type/Permeability
[ ] Peat/H [ ] Mineral/M [x] Muck/L

Dominant Surficial Geological Material of Watershed

- [ ] Till
- [x] Alluvium
- [ ] Stratified Sand and Gravel
- [ ] Stratified Fine Sand and Silt

Thickness of Organics
[ ] <1 foot [ ] 1-5 feet [ ] >5 feet

HYDROLOGICAL ELEMENTS

Hydrologic Position of Wetland

- [ ] Perched Wetland
- [x] Water Table Wetland
- [ ] Water/Artesian Wetland
- [ ] Artesian Wetland

Groundwater Relationship

- [x] Discharge Wetland
- [ ] Recharge Wetland
- [ ] Combination

Transmissivity of Aquifer

- [x] Low <10,000 gal/day/ft
- [ ] Moderate 10,000 - 40,000 gal/day/ft
- [ ] High >40,000 gal/day/ft

Dominant Hydrologic Condition
[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [x] 6

Connection by Surface Water to a Riparian System
[x] Yes [ ] No

Watershed Land Use

- [ ] Rural
- [ ] Rural/Residential
- [x] Urban
- [ ] Industrial
- [ ] Other________________

Water Level Fluctuation
[ ] H [x] L [ ] Vernal Pool

Groundwater Outflow From Wetland
[x] Absent [ ] Present

Inlet
[ ] A [x] P [ ] E
[ ] Present, to wetland________________

Inlet
[ ] A [ ] P [ ] E
[ ] Present, to wetland________________

Inlet
[ ] A [ ] P [ ] E
[ ] Present, to wetland________________

Inlet
[ ] A [ ] P [ ] E
[ ] Present, to wetland________________

Inlet
[ ] A [ ] P [ ] E
[ ] Present, to wetland________________

Outlet
[x] A [ ] P [ ] E
[ ] Present, to wetland________________

Outlet
[ ] A [ ] P [ ] E
[ ] Present, to wetland________________

Percent Wetlands Bordering Open Water vs. Upland
[ ] <33% [x] 34-66% [ ] 67-100%
[ ] Does not border

Fetch
[ ] >2000 ft. [ ] <2000 ft.

Depth of Lake
[ ] Deep >6 ft. [ ] Shallow <6 ft.

SOCIO-ECONOMICAL ELEMENTS

Hydrologically Connected to a

- [x] Small stream
- [ ] River
- [ ] Lake
- [ ] Combination
- [ ] Not connected

Public Access to Wetland

- [x] Within 100 ft. of road
- [ ] Access by passable waterway
- [ ] Isolated

Surrounding Population Density

- [ ] <½ person/acre (<320/mi²)
- [ ] 0.5 - 1.9 p/a (320-1220/mi²)
- [x] >2 p/a (>1220/mi²)

Local Scarcity to Nearest Similar Type

- [ ] <200 feet
- [x] 201 to 1000 feet
- [ ] >1000 feet

Known Crop Value or Potential

- [x] None
- [ ] Supports 1 family for part of year
  Type________________
- [ ] Supports viable commercial interest
  Type________________

Legal Accessibility to Wetland
[ ] Public [ ] Private [x] Restricted

Cultural Significance
[ ] Archeological/Historic [x] None

ts	Element Weight	Condition Weight	
· Fisheries[a]	NA[b]	NA	Present
		NA	Not Present
nce of gered or tened Species[a]	NA	NA	Present
		NA	Not Present
ant Wetland s	5	1	Stream or Brookside wetland
		0	Open fresh water
	0	4	Deep fresh marsh(aquatic bed)
		5	Shallow fresh marsh
		5	Yearly flooded floodplain
		2	Wet meadow
		4	Shrub swamp
		2	Wooded swamp (deciduous)
		4	Wooded swamp (coniferous)
		3	Bog
er of Wetland ses (Richness)	4	5	≥5
		4	4
	8	3	3
		2	2
		1	1
er of Wetland lasses (Richness)	3	5	>10
		4	6-9
	6	3	4-5
		2	2-3
		1	1
tative ersperssion	4	3	High
	4	2	Moderate
		1	Low
rounding Habitat	3	3	>90% of two or more of listed types
	6	2	50-90% of one or more 90% of one
		1	<50% of one or more listed
er/Cover Ratio ver Typed)	3	4	25-75% scattered
		2	25-75% peripheral
	6	3	75% or <25% scattered
		1	100% cover:>75% or 25% peripheral
ber of Plant cies (Vegetative cies Richness)	2	1	Low
	2	2	Medium
		3	High
portion of dlife Food Plants	1	1	Low
		2	Moderate
	1	3	High
getative Density	2	3	High
		2	Moderate
	2	1	Low
tland Juxtaposition	3	3	Highly favorable
	6	2	Moderately favorable
		0	Unfavorable
drological Position roundwater nnection)	2	1	Perched wetland
	8	4	Water table wetland
		3	Water table/artesian wetland
		3	Artesian wetland
ater Level luctuation	1	2	Low
	2	1	Vernal pool
		0	High

K-45

Elements	Element Weight	Condition Weight	Conditions
Surface Water	1	1	Connected to a small stream
		2	Connected to a river
	1	3	Connected to a lake
		4	Connected to a combination
		0	Not connected
Percent Wetland Bordering on Open water	4	1	<33%
	12	2	34-66%
		3	67-100%
		0	Does not border
Size	5	3	Large ≥ 4.6 acres
	10	2	Medium 1.1-4.5 acres
		1	Small ≤ 1.0 acres
		Range 29-158 Mean 93	

a-preemtive factors
b-not applicable

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Figure 10. Hydrologic Support Function Model

Elements	Element Weight	Condition Weight	Conditions
Size	4	3	Large ≥ 4.6 acres
	8	2	Moderate 1.1-4.5 acres
		1	Small ≤ 1.0 acres
Topographic Configuration	1	3	Semi-closed basin
		2	Valley
	3	1	Hillside
		0	Closed Basin
Dominant Hydrologic Type	5	1	Condition 1
		2	Condition 2
	0	3	Condition 3
		4	Condition 4
		5	Condition 5
		0	Condition 6
Water Level Fluctuation	2	2	Low
	4	1	High
Outlet	4	2	Perennial Outlet
		1	Ephemeral Outlet
	0	1	Groundwater Outflow
		0	Absent
Inlet	1	2	Perennial
	2	1	Ephemeral
		0	Absent
Percent Wetland[a] Bordering on Open Water	4	1	<33%
		2	34-66%
	12	3	67-100%
		0	Does not border
	29	Range 6-70[b] Mean 36	

a Applies only to those wetlands with an outlet
b Total value for one inlet and one outlet only.

Elements	Element Weight		Condition Weight	Conditions
Surficial Geology	3	6	1	Till
			4	Stratified sand and gravel
			3	Stratified fine sand and silt
			2	Alluvium
Organic Material	2	2	3	Absent
			2	High permeability
			1	Low permeability
Hydrologic Position	5	20	2	Perched wetland
			4	Water table wetland
			2	Water table/artesian wetland
			1	Artesian wetland
Transmissivity of Aquifer	4	4	1	Low <10,000 gal/day/ft
			2	Med. 10,000-40,000 gal/day/ft
			3	High >40,000 gal/day/ft
Inlet	1	3	1	Absent
			3	Perennial
			2	Ephemeral
Outlet	2	6	3	Absent
			2	Perennial
			1	Ephemeral
Size	3	6	3	Large ≤ 4.6 acres
			2	Medium 1.1-4.5 acres
			1	Small ≥ 1.0 acres
			Range 20-60* Mean 44	

* Total value for one inlet and one outlet only. Some wetlands may have more than one inlet or outlet but the range above is for wetlands with only one inlet and one outlet.

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Figure 12. Storm and Flood Water Storage Function Model

Elements	Element Weight		Condition Weight	Conditions
Dominant Wetland Class	2	2	1	Stream or brookside wetland
			1	Open fresh water
			2	Deep fresh marsh (aquatic bed)
			4	Shallow fresh marsh
			4	Yearly flooded floodplain
			3	Wet meadow
			5	Shrub swamp
			4	Wooded swamp
			3	Bog
Percent Open Water	2	2	3	0-33%
			2	34-66%
			1	67-95%
			0	96-100%
Vegetative Density	4	4	3	High
			2	Moderate
			1	Low
Topographic Configuration	2	6	4	Closed Basin
			3	Semi-closed basin
			2	Valley
			1	Hillside
Topographic Position in Watershed	3	3	3	Upper
			2	Intermediate
			1	Lower

Elements	Element Weight		Condition Weight	Conditions
Surficial Material of Watershed	2	4	4	Till
			1	Stratified sand and gravel
			3	Stratified fine sand and silt
			2	Alluvium
Surficial Geologic Material of Wetland Banks	2	6	1	Till
			4	Stratified sand and gravel
			2	Stratified find sand and silt
			3	Alluvium
Organic Material	1	1	2	High permeability
			1	Low permeability
			0	Absent
Dominant Hydrologic Type	5	30	1	Condition 1
			2	Condition 2
			3	Condition 3
			4	Condition 4
			5	Condition 5
			6	Condition 6
Hydrologic Connection	4	8	1	Not part of riparian system
			2	Part of riparian system
Water Level Fluctuation	3	3	2	High
			1	Low
Inlet	1	2	2	Perennial
			1	Ephemeral
			0	Absent
Outlet	1	0	1	Perrennial
			2	Ephemeral
			0	Absent
Size	4	8	3	Large ≥ 4.6 acres
			2	Medium 1.1-4.5 acres
			1	Small ≤ 1.0 acres
			Range 31-123 Mean 77	

*Total value for one inlet and one outlet only. Some wetlands may have more than one inlet or outlet but the range above is for wetlands with only one inlet and one outlet.

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Element	Element Weight		Condition Weight	Condition
Wetland Borders[a] Lake or Stream	NA[b]		NA	Yes
			NA	No
Vegetative Density	3	0	0	Open fresh water
			0	Stream and brookside
			1	Deep fresh marsh (aquatic bed)
			2	Shallow fresh marsh
			4	Yearly floodplan
			1	Wet meadow
			4	Shrub swamp
			4	Wood swamp
			3	Bog
Surficial Material Underlying Wetland	1	3	2	Till
			1	Stratified sand and gravel
			4	Stratified find sand and silt
			3	Alluvium
Fetch (Lakes only)	4		2	Over 2000 ft.
			1	Under 2000 ft.
Depth of Lake	1		2	Deep 6 ft.
			1	Shallow 6 ft.
			Range 3-32 Mean 17	

[a]preemtive
[b]not applicable

Elements	Element Weight		Condition Weight	Conditions
Dominant Hydrologic Type	4	24	1	Condition 1
			2	Condition 2
			3	Condition 3
			4	Condition 4
			5	Condition 5
			6	Condition 6
Hydrologic Connection	2	4	1	Not part of the riparian sy
			2	Part of riparian system
Inlet	2	4	2	Perennial
			1	Ephemeral
			0	Absent
Outlet	3	0	2	Perennial
			1	Ephemeral
			0	Absent
Size	4	8	3	Large ≥ 4.6 acres
			2	Moderate 1.1-4.5 acres
			1	Small ≤ 1.0 acres
			Range 18-98[a] Mean 58	

[a]Total value for one inlet and one outlet only. Some wetlands may have more than one inlet or outlet but the range above is onl for wetlands with one inlet and one outlet.

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Figure 14. Water Quality Maintenance Function Model

Elements	Element Weight		Condition Weight	Conditions
Dominant Wetland Class	4	0	1	Stream or brookside wetland
			0	Open fresh water
			3	Deep fresh marsh (aquatic bed)
			4	Shallow fresh marsh
			4	Yearly floodplain
			3	Wet meadow
			4	Shrub Swamp
			2	Wooded swamp
			2	Bog
Percent open water	1	1	3	0-33%
			2	34-66%
			1	67-95%
			0	96-100%
Vegetative Density	3	3	3	High
			2	Moderate
			1	Low
Topographic Configuration	3	9	4	Closed Basin
			3	Semi-closed basin
			2	Valley
			1	Hillside
Topographic Position in Watershed	2	6	1	Upper
			2	Intermediate
			3	Lower
Organic Material	1	2	1	High permeability
			2	Low permeability
			0	Absent

Figure 15. Cultural and Economic Function Model

Elements	Element Weight		Condition Weight	Conditions
Dominant Wetland Class	4	0	0	Stream of brookside
			0	Open fresh water
			4	Deep fresh marsh
			4	Shallow fresh marsh
			0	Yearly flooded floodplain
			2	Wet meadow
			3	Shrub swamp
			5	Wooded swamp (deciduous)
			6	Wooded swamp (coniferous)
			3	Bog
Access	3	9	3	Within 100' of road
			2	Access by passable waterway
			1	Isolated
Size	8	16	3	Large ≥ 4.6 acres
			2	Medium 1.1-4.5 acres
			1	Small ≤ 1.0 acres
			Range 11 Mean 34	

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Figure 16. Recreational Function Model

Elements	Element Weight	Condition Weight	Conditions
Dominant Wetland Class	3	0	Stream or brookside
		6	Open fresh water
		6	Deep fresh marsh
	0	5	Shallow fresh marsh
		0	Yearly flooded floodplain
		0	Wet meadow
		2	Shrub swamp
		2	Wooded swamp (deciduous)
		3	Wooded swamp (coniferous)
		2	Bog
Percent Open Water	3	1	0-33%
		2	34-66%
	9	3	67-95%
		0	96-100%
Surface Water Association	4	1	Connected to a small stream
		2	Connected to a river
	4	3	Connected to a lake
		4	Connected to a combination
		0	Not connected
Access to Public	2	3	Within 100' of road
	6	2	Access by passable waterway
		1	Isolated
Size	4	3	Large ≥ 4.6 acres
	8	2	Medium 1.1-4.5 acres
		1	Small ≤ 1.0 acres
Legal Access	2	2	Yes
	2	1	No
Output From Biological Function	3	3	High 116-158
	6	2	Moderate 73-115
		1	Low 29-72
		Range 11-74	
	35	Mean 42	

Figure 17. Aesthetic Function Model

Elements	Element Weight	Condition Weight	Conditions
Dominant Wetland Class	4	0	Stream or brookside wetland
		6	Open fresh water
		5	Deep fresh marsh
	0	4	Shallow fresh marsh
		0	Yearly flooded floodplain
		0	Wet meadow
		2	Shrub swamp
		3	Wooded swamp (deciduous)
		3	Wooded swamp (coniferous)
		5	Bog
Number of Subclasses (Richness)	3	4	6-9
	6	2	2-3
		1	1
Percent Open Water	4	1	0-33%
		3	34-66%
	16	4	67-95%
		0	96-100%
Access to Public	3	3	Within 100 ft. of road
	9	2	Access by passable waterway
		1	Isolated
Local Scarcity	3	1	<200 ft. to nearest similar type
	6	2	201-1000 ft to nearest similar type
		3	>1000 ft. to nearest Similar type
		Range 9-66	
		Mean 37	
		37	

Figure 18. Educational Function Model

Elements	Element Weight	Condition Weight	Conditions
Subclass Richness (Lateral Diversity)	3	4	6-9
		3	4-5
	6	2	2-3
		1	1
Access to Public	4	3	Within 100' of road
	12	2	Access by passable waterway
		1	Isolated
		Range 7-24	
	18	Mean 15	

COVER TYPE DESCRIPTION FORM

Project: Sudbury Annex, P 36 & 37
Field Crew: Kim, Vangalio, Azzopardi

Date: 6-21
Photo #(s): 3-16

Cover Type No.: 2
Cover Type Name: Mixed forest

VEGETATION: (* = dominants)

Trees (DBH= veg. density= 90 %
white pine * white spruce
red oak red pine

Saplings/shrubs (veg. density=):
red maple low blueberry ironwood
red pine white oak A. chestnut

Woody Vines (veg. density= 0):
none

Herbs (veg. density= 15):
Canada mayflower wood fern sassparilla grasses
bracken fern wood pine starflower

Comments (diversity, quality, exotics):
- thick organic layer of needles
- relatively open understory

SOIL COMPOSITION: 10 YR 6/8 sandy

SLOPE: variable 10-20%

HYDROLOGY: absent

WATER BODIES: adjacent to pond and Marlboro Brook

WILDLIFE:

Species Observed:
chickadee
red squirrel

Other Evidence of Wildlife Use:

Wildlife Values:

____	travel corridors	____	cavity trees
✓	abundance of cover	____	standing dead snags
✓	abundance of food	____	large, contiguous fore:
✓	abundance of edge		

Available Wildlife Foods:
pine cones, acorns, berries

DISTURBANCE: (fire, logging, ditching, stressed veg., stained soils, drums

- near roads

BASAL AREA FIELD FORM

Project: Sudbury Annex, P36 & 37
Cover type number: 2
Plot radius: ~30'

Date: 6-21
Crew: Kim, Vangalio, Azzopardi

DBH(in.)	Midpt.	BA/tree	SPECIES white pine	red oak	white spruce	red pine		
4-6	5	19.63	~~IIII~~ II	IIII	I			
6-8	7	38.47	~~IIII~~ III	II				
8-10	9	63.59	I					
10-12	11	94.99		I				
12-14	13	132.67						
14-16	15	176.63	I					
16-18	17	226.87						
18-20	19	283.39						
20-22	21	346.19						
22-24	23	415.27						
24-26	25	490.63						
26-28	27	572.27						
28-30	29	660.19				I		
30-32	31	754.39						
32-34	33	854.87						
34-36	35	961.63						
Total BA/species			685.39	250.45	19.63	660.19		
Total BA/plot			1615.66 →					
Relative dominance (%)			42	16	1	41		

FOR USE WITH 1987 CORPS WETLANDS DELINEATION MANUAL

Project Title: Sudburry P36 P37 File Number:

Cover type 2 ~~Transect~~: Plot: Date: 6-21-93

DATA -- VEGETATION Stratum and Species (DOMINANTS ONLY)	Dominance Ratio	Percent Dominance	NWI Status
Tree			
Pinus strobus	685.39 / 1615.66	42	FACU
Pinus resinosa	660.19 / 1615.66	41	FACU

Note: use asterisk * to indicate FAC-, FACU, or UPL species with observed adaptions to wetland hydrology

TALLY (Dominants ONLY)

OBL	FACW	FAC	*FAC-	*FACU	*UPL	FAC-	FACU	UPL

SUBTOTAL (HYDROPHYTES): ______ SUBTOTAL: 1

TOTAL: ______

100 x SUBTOTAL (HYDROPHYTES) / TOTAL = ______ = PERCENT HYDROPHYTES

DESCRIBE VEGETATION DISTURBANCE:

DESCRIBE ADAPTATIONS:

DATA -- SOIL Soil Taxonomy: Typic Udipsamment

Corps of Engineers Regional Drainage Class: excessively drained Criterion:

Is Published Soil Survey Available? Yes ☒ No ☐ Title/Date: Middlesex County 1991

Soil Type Mapped: Windsor Field Observations Confirm Type Mapped? Yes ☒ No ☐

Depth	Horizon	Matrix Color (Munsell, Moist)	Color of Mottles (Munsell, Moist) Abundance/Contrast	USDA Texture, Iron or manganese nodules or concretions, restrictive layers, root distribution, oxidized rhizospheres, etc.
2-5		7.5YR 4/4		sandy
5-10		10YR 6/8		sandy

Remarks:

Sketch Landscape Position:

FOR USE WITH 1987 CORPS WETLANDS DELINEATION MANUAL

SOIL DETERMINATION

NOTE:
1. "NO" to all the following is evidence that the soil is NOT HYDRIC
2. This checklist is valid for use by the New England Corps of Engineers; use outside the six New England States may be inappropriate
3. This interpretive routine may be inappropriate in unusual cases

Yes	No	
☐	☐	Soil is frequently PONDED or FLOODED for a duration longer than two weeks during the growing season. (attach an explanation of the basis for your conclusions).
☐	☐	The soil meets the Corps of Engineers regional criteria as a VERY POORLY DRAINED SOIL* and there is no evidence of altered hydrology
☐	☐	The soil meets the Corps of Engineers regional criteria as a POORLY DRAINED SOIL* and there is no evidence of altered hydrology
☐	☐	The soil meets the Corps of Engineers regional criteria as a SOMEWHAT POORLY DRAINED SOIL that has either of the following two characteristics*:

Yes NO
☐ ☐ 1. Within 8 inches of the soil surface there are:

Yes No
- ☐ ☐ a. soil mottles within an A or Ap horizon and the subsoil is mottled throughout; OR
- ☐ ☐ b. common to many, distinct or prominent mottles with a matrix of chrome 3 or less; OR
- ☐ ☐ c. distinct or prominent oxidized rhizospheres and the subsoil is mottled throughout.

☐ ☐ 2. Within 24 inches of the soil surface, there are mottles which are common to many, distinct or prominent, and that are chrome 2 or less, and one of the following:

Yes No
- ☐ ☐ a. In the horizon that lies within 10 inches of the soil surface and directly beneath a dark** A or Ap horizon, the matrix is chrome 3 or less; the mottles are at least 10% in abundance and distinct or prominent.
- ☐ ☐ b. When a dark** Ap horizon is between 10 and 14 inches thick, wetness morphology may be masked by organic matter. Normally, these problem situations will be considered hydric when: I. hydrophytes are prevalent, II. there is no evidence of altered hydrology, and III. in the horizon that lies directly beneath the Ap horizon, the matrix color is chrome 3 or less and mottles are at least 10% in abundance and distinct or prominent.

☐ Check here and attach a description of your procedures and conclusions if one of the following options were chosen for your hydric soil determination: measured redox potentials, colormetric test for ferrous iron test (α,α,-Dipyridil), or other measurements and observations.

* Typically in New England, soils having these morphologies will be classified in an aquic suborder or an aquic subgroup in soil taxonomy.
** Note: a dark A or Ap is defined as having a value of 3 or less and a chrome of 2 or less

Remarks:

DATA & DETERMINATION HYDROLOGY

NOTE:
1. Hydrology is often the most difficult feature to observe
2. Interpretations must consider the appropriateness of the observations in light of the season, recent weather conditions, and watershed alterations, etc
3. Interpretation of hydrology may require repeated observations over more than one season

☐ Recorded Data:
- Stream, lake or tidal gage — Identification: ______
- Aerial Photograph — Identification: ______
- Other — Identification: ______

☐ No Recorded Data Available

REPORT ANY OF THE FOLLOWING OBSERVATIONS:
- Depth to Free Water: >18"
- Depth to Saturation: >18"
- Describe Altered Hydrology: ______

- ☐ Inundated
- ☐ Saturated in upper 12 inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns within Wetlands

Remarks

CONCLUSIONS

Project Title:

Delineator:

Transect: Plot: Date:

	Yes	No
Greater than 50 Percent Hydrophytes?	☐	☐
Hydric Soils Criterion Met?	☐	☒
Wetland Hydrology Present?	☐	☒

IS THIS DATAPOINT WITHIN A WETLAND? Yes ☐ No ☐

Remarks

COVER TYPE DESCRIPTION FORM

Project: Sudbury Annex, P36 & 37
Field Crew: Kim, Azzopardi, Vangalio

Date: 6-21
Photo #(s): 3-17, 18 & 19

Cover Type No.: 3
Cover Type Name: Open/disturbed

VEGETATION: (* = dominants)

Trees (DBH= veg. density= scattered
cottonwood (not in plot)

Saplings/shrubs (veg. density=):
low blueberry, red oak, paper birch, gray birch*, big tooth aspen, sweetfern, scotch pine, white pine, fire cherry*

Woody Vines (veg. density=):
rubus spp.

Herbs (veg. density=):
bush clover, asters, goldenrods, whorled loosestrife, sweet white clover, grasses*, cinquefoil

Comments (diversity, quality, exotics):
- trees and shrubs are located around the 2cd building (western)
- eastern end is more open/herbaceous

SOIL COMPOSITION: disturbed

SLOPE: 0-3 %

HYDROLOGY: absent

WATER BODIES: none (near Marlboro Brook)

WILDLIFE:

Species Observed:

Other Evidence of Wildlife Use:

Wildlife Values:
_____ travel corridors
_____ abundance of cover
_____ abundance of food
_____ abundance of edge
_____ cavity trees
_____ standing dead snags
_____ large, contiguous fore

Available Wildlife Foods:
berries, catkins (buds + seeds)

DISTURBANCE: (fire, logging, ditching, stressed veg., stained soils, drums
- paved areas, two sheet metal buildings, & roads

BASAL AREA FIELD FORM

Project: Sudbury Annex, P36 and 37
Cover type number: 3
Plot radius: ~30'

Date: 6-21
Crew: Kim, Vangalio, Azzopardi

DBH(in.)	Midpt.	BA/tree			SPECIES			
4-6	5	19.63						
6-8	7	38.47						
8-10	9	63.59						
10-12	11	94.99						
12-14	13	132.67						
14-16	15	176.63						
16-18	17	226.87						
18-20	19	283.39		No	Trees			
20-22	21	346.19						
22-24	23	415.27						
24-26	25	490.63						
26-28	27	572.27						
28-30	29	660.19						
30-32	31	754.39						
32-34	33	854.87						
34-36	35	961.63						
Total BA/species								
Total BA/plot								
Relative dominance (%)								

COVER TYPE DESCRIPTION FORM

Project: Sudbury Annex, P36 & 37
Field Crew: Azzopardi, Kim, Vangalio

Date: 6-21
Photo #(s): 3-20

Cover Type No.: 4
Cover Type Name: Oak forest

VEGETATION: (* = dominants)

Trees (DBH= veg. density= 50
red oak* red maple
scarlet oak*

Saplings/shrubs (veg. density= 80):
red maple low blueberry red oak sweetfern
A. chestnut white pine white oak scarlet oak

Woody Vines (veg. density= 0):
none

Herbs (veg. density= 10):
partridge berry bracken fern
wood pine grasses

Comments (diversity, quality, exotics):
- thick leaf litter

SOIL COMPOSITION: /

SLOPE: 2-4%

HYDROLOGY: absent

WATER BODIES: none

WILDLIFE:

Species Observed:
gypsy moths/catepillars ovenbird
red squirrel woodpecker (heard)

Other Evidence of Wildlife Use:

Wildlife Values:

- [ ] travel corridors
- [x] abundance of cover
- [x] abundance of food
- [ ] abundance of edge
- [x] cavity trees
- [ ] standing dead snags
- [ ] large, contiguous fore[s]

Available Wildlife Foods:
acorns, blueberries, seeds

DISTURBANCE: (fire, logging, ditching, stressed veg., stained soils, drums

BASAL AREA FIELD FORM

Project: Sudbury Annex, P36 + 37
Cover type number: 4
Plot radius: ~30'

Date: 6-21
Crew: Vangalio, Kim, Azzopardi

DBH(in.)	Midpt.	BA/tree	red oak	scarlet oak	red maple			
					SPECIES			
4-6	5	19.63	|		||||			
6-8	7	38.47	|||		|			
8-10	9	63.59	||					
10-12	11	94.99	|					
12-14	13	132.67	|	|				
14-16	15	176.63	|					
16-18	17	226.87						
18-20	19	283.39						
20-22	21	346.19						
22-24	23	415.27						
24-26	25	490.63		|				
26-28	27	572.27						
28-30	29	660.19						
30-32	31	754.39						
32-34	33	854.87						
34-36	35	961.63						
Total BA/species			666.51	623.30	116.99			
Total BA/plot			1406.80 →					
Relative dominance (%)			47	44	9			

COVER TYPE DESCRIPTION FORM

Project: Sudbury Annex, P36 + 37
Field Crew: Vangalio, Azzopardi, Kim

Date: 6-21
Photo #(s):
3-21

Cover Type No.: 5
Cover Type Name: Pine plantation

VEGETATION: (* = dominants)

Trees (DBH= veg. density= 80
red pine* red oak
white pine scarlet oak

Saplings/shrubs (veg. density= 50):
A. chestnut red maple low blueberry
white pine red pine

Woody Vines (veg. density= 0):
none

Herbs (veg. density= 10):
pink ladyslipper bracken fern mosses (on trunks)
partridge berry

Comments (diversity, quality, exotics):
- thick leaf/needle layer
- planted

SOIL COMPOSITION: /

SLOPE: 0-3%

HYDROLOGY: absent

WATER BODIES: none

WILDLIFE:

Species Observed:
turkey (heard)
red squirrel

Other Evidence of Wildlife Use:

Wildlife Values:

___	travel corridors
___	abundance of cover
✓	abundance of food
✓	abundance of edge
___	cavity trees
✓	standing dead snags
___	large, contiguous fore:

Available Wildlife Foods:
pine cones, acorns, berries

DISTURBANCE: (fire, logging, ditching, stressed veg., stained soils, drums

Note: b. cherry, w. oak, g. birch, b.t. aspen, and r. oak accur along the auter edges along the roads + parking/paved areas

BASAL AREA FIELD FORM

Project: Sudbury Annex, P36 + 37
Cover type number: 5
Plot radius: ~30'

Date: 6-21
Crew: Vangalio, Azzopardi, Kim

DBH(in.)	Midpt.	BA/tree	red pine	white pine	red oak	scarlet oak		
					SPECIES			
4-6	5	19.63	𝍸	𝍸	||			
6-8	7	38.47	||					
8-10	9	63.59	||	||		|		
10-12	11	94.99	|||	||	|	|		
12-14	13	132.67						
14-16	15	176.63						
16-18	17	226.87						
18-20	19	283.39						
20-22	21	346.19						
22-24	23	415.27						
24-26	25	490.63						
26-28	27	572.27						
28-30	29	660.19						
30-32	31	754.39						
32-34	33	854.87						
34-36	35	961.63						
Total BA/species			587.24	415.31	134.25	158.58		
Total BA/plot			1295.38 →					
Relative dominance (%)			45	32	10	13		

L

APPENDIX L

RAPID BIOASSESSMENT REPORT

APPENDIX L

RAPID BIOASSESSMENT REPORT

L.1 INTRODUCTION

Rapid bioassessment (RBA) is a method of determining, in a short period of time with a moderate field effort, the biological condition of a stream or river, and whether or not the system is potentially impaired from its natural state. Rapid bioassessment of benthic macroinvertebrates have three protocols to choose from: Protocol I provides a screening level or reconnaissance assessment that involves the systematic documentation of specific visual observations; Protocol II provides a more intense assessment requiring the systematic collection and analysis of benthic taxa in the field; and Protocol III which involves a rigorous bioassessment including a systematic field collection and subsequent laboratory analysis of benthic taxa (EPA/444/4-89-001). Based on the SOW and level of effort chosen for this task, Protocol II was deemed appropriate to study the biological condition of streams at the Annex.

Protocol II involves the standardized collection, enumeration and identification of major benthic taxa (filters, scrapers, shredders) to the family level in riffle/run habitats. After the enumeration and identification of macroinvertebrates, eight distinct functional parameters (see page L-7) are measured and are combined into an overall score that evaluates the biotic integrity of the stream. This protocol can also be used in non-wadable streams or areas where suitable substrates are not available. Standard data sheets are used to trace each sampling location. Collections are compared to an off-site background stream, and an evaluation is made as to the impairment, or lack thereof, of the stream from input within the watershed. The stream can then be ranked as to its biological condition: non-impaired, moderately impaired, or severely impaired, where impaired is defined as a reduction in species comparable to the best situation to be expected within an ecoregion. Protocol II also involves stream habitat assessment such as stream flow, bottom characterizations, and riparian vegetation descriptions. In addition, water quality parameters such as dissolved oxygen (DO), temperature, pH, conductivity, odor, and turbidity are determined. These physical and chemical parameters are standard to many aquatic studies and are used to classify a station on the basis of its similarity to the expected condition, reference station, and its apparent potential to support an acceptable level of biological health.

L.2 SAMPLING METHODS

Between 24 and 26 May 1993, an E & E field team surveyed and sampled four RBA sites at the Sudbury Training Annex. In the sampling plan, more sites were intended for sampling but were not sampled due to habitat conditions unsuitable for RBA analysis.

When a section of stream intended for RBA analysis was surveyed by the field team, the entire length was examined for the best location of riffle/run habitat with suitable

substrate. Once the RBA collection site was chosen, the Global Positioning System (GPS) was used to accurately identify the location and to record information about the site. Also, a labeled survey stake was placed in a visible spot and nearby trees were marked with survey tape. The stream width and depth were measured at several points at the site and an average was calculated. Using a portable field meter, the following water quality measurements were taken: temperature, dissolved oxygen, pH, and conductivity. All meters were calibrated for accuracy before use at each RBA site. Stream velocity was measured at both sides and the center of the stream with a portable meter.

Two macroinvertebrate subsamples were collected at each RBA site by placing a small mesh kick net immediately downstream and then scrubbing (with a scrub brush) and kicking up the substrate in a ~1.0 square meter area. One sub-sample was collected from a high velocity area and the other from a low velocity area. After collecting the samples, a composite was made to represent the combined microhabitats present in the area, and then placed into a pre-gridded and numbered white plastic dish pan, approximately five centimeters square in area. Then, using fine tweezers, approximately 100 invertebrates were collected by randomly picking them from numbered squares in the grid. All organisms were placed into a pre-labeled, 8-ounce jar with sufficient isopropyl alcohol for preservation.

In the area immediately surrounding the RBA site and as close as possible to the stations, an undisturbed-course, particulate organic matter (CPOM) sample was collected from the stream with a kick net. The CPOM was primarily composed of oak and pine materials. The CPOM was placed into the white dish pan and all organisms were collected and jarred. If less than 50 organisms were collected, another CPOM sample was collected and the organisms added to the first sample.

Once the sampling process was completed, the collected invertebrates were identified to family level, enumerated, and placed into jars containing isopropyl alcohol mixed with water to preserve the samples for later use if required. All data collected during RBA sampling and analysis were recorded in field logbooks.

L.3 STREAM CHARACTERIZATION

The following provides a brief characterization of the existing environment at the four locations where an RBA was conducted. The RBA station on Taylor Brook is considered as a reference for all the other stations because it is the only one located outside and upgradient of the Annex. General location, vegetative density, stream bed composition, physical and chemical parameters as well as preliminary results are discussed for each location.

L.3.1 Taylor Brook

L.3.1.1 Station No. 1 (TB-1). This RBA station was designated as the reference station for the RBA study at the Annex. This station was located near headwaters of Taylor Brook in a physically undisturbed off-site, forested area, located behind the Digital Equipment Corporation's back parking lot (Plate 4). This designation was based primarily on the

similarity of brook habitat, streambed composition, and infield measured physical and chemical water quality parameters at station TB-1 compared with site-impacted RBA stations. Station TB-1 was not a pristine macroinvertebrate environment primarily due to adjacent human activity (Digital Equipment Corporation), but was the best available, off-site reference environment for the RBA study. Overall, it is believed that TB-1 can be used as a reference station to qualitatively assess the relative biotic integrity of the remaining stations.

At the time of the survey, the canopy closure was approximately 80 percent, and the steeply sloped stream banks were well vegetated. There were indications of bank erosion during high stream flows. The stream's bottom substrate consisted of approximately 15 percent cobble, 30 percent gravel, 40 percent sand, and 15 percent silt at the RBA station; other areas of the streambed were mostly sand and silt.

The average width of the stream at this site was 2 feet, and the average water depth was 3 inches. The average stream velocity was 0.01 meters per second (m/s). The water temperature was 15.5°C and the DO was 4.5 parts per million (ppm). The pH was 5.82, and the conductivity was measured at 179.4 micromhos per centimeter (μmhos).

The CPOM component for this site was very limited due to the high energy of the stream channel. There were only two small pockets of CPOM available for use. However, there was a sufficient amount of CPOM found to adequately allow for the examination of shredder relative abundance.

A total of four orders of macroinvertebrates, of which six families were represented, were collected at this station.

L.3.2 Marlboro Brook

L.3.2.1 Station No. 1 (MB–1). This RBA station was located slightly downstream from the access road crossing and just downstream from the headwaters of Marlboro Brook near Site A11 (Plate 4). This station was located in a forested area, which had a canopy closure of approximately 90 percent. The stream banks were well vegetated but showed signs of moderate erosion and siltation occurring during high water periods. The stream bottom composition consisted of approximately 10 percent cobble, 30 percent gravel, 20 percent sand, 30 percent silt, and 10 percent clay. Much of the rock substrate available was most likely due to past road construction, since the stream bottom composition both upstream and downstream of this site was mostly sand and silt.

The average width of the stream was 3 feet, and the average depth was 3 inches. The average stream velocity was measured at 0.25 m/s. The water temperature was 13.4°C and the DO was 5.0 ppm. The pH was 5.25, and the conductivity was 26.9 μmhos.

Slight to moderate amounts of filamentous algae grew throughout the stream. In addition, CPOM was plentiful within the stream at the sampling location. Macroinvertebrate collection at this station identified four orders in which six families were represented.

L.3.2.2 Station No. 2 (MB–2). The second RBA station on Marlboro Brook was located downstream from the first site, and off of the Annex property (Plate 4). This site was downstream from the ponded area of Marlboro Brook before it crosses Surrey Lane, behind some residential properties, and just below the remains of an old stone foot bridge.

The canopy closure was approximately 80 percent, and the stream banks were well vegetated. Some moderate signs of erosion during high water periods and some siltation were observed. The stream bed consisted of approximately 5 percent cobble, 40 percent gravel, 30 percent sand, and 25 percent silt. The available rocky substrate was a result of the degradation of the foot bridge's foundation, since stream bed composition upstream and downstream was mostly sand and silt.

The average width of the stream at this site was 3 feet and the average depth was 3 inches. The average stream velocity was 0.04 m/s. The water temperature was 12.8°C, and the DO was 3.6 ppm. The pH was 4.04, and the conductivity was 14.4 μmhos. The water was slightly stained a brownish color.

Throughout the stream sampling section, no macrophytic algae was found however, CPOM was present throughout the area. A total of six orders of macroinvertebrates in which 10 families were represented, were collected at this station.

L.3.3 Honey Brook

L.3.3.1 Station No. 1 (HB–1). This RBA station was located on the Annex, downstream from the Puffer Pond Road crossing of Honey Brook. The station was in a partially forested area just north of Puffer Pond Road, which had a canopy closure of approximately 10 percent. The stream banks were completely vegetated with little evidence of bank erosion or siltation in the channel. The stream bottom composition consisted of approximately 2 percent boulders, 40 percent cobble, 30 percent gravel, 20 percent sand, and 8 percent silt.

The average width of the stream was 2.5 feet, and the average depth was 9 inches. The average stream velocity was 0.08 m/s. The water temperature was 15.5°C, and the DO was 4.8 ppm. The pH was 6.34, and the conductivity was 26.8 μmhos. The water was slightly stained a brownish color.

Filamentous macrophytic algae was found throughout the area in varying amounts along with emergent vegetation. In addition, various pockets of CPOM were found within depositional areas through the site. Macroinvertebrate collected for this location revealed five orders in which 10 families were represented.

L.4 DISCUSSION OF RAPID BIOASSESSMENT RESULTS

The data analysis procedures used in the Rapid Bioassessment Protocol II (RBAII) integrate several community, population, and functional parameters into a single evaluation of biotic integrity. Each metric parameter measures a different component of community

structure at each station and has a different range of sensitivity for induced impairment. There are eight metrics used in the RBAII. The benthic invertebrated data (family level only) are used to obtain a numerical value for each metric. The calculated values are then compared to values obtained from the background station and a biological condition score of 0, 3, or 6 is assigned to each station's metrics according to the comparability (percent similarity) of the calculated value and background value.

The eight metrics used in RBAII include:

- Taxa richness;
- Modified family biotic index (FBI);
- Ratio of scraper to filtering collector functional feeding groups;
- Ratio of Ephemeroptera, Plecoptera, and Tricoptera (EPT) and Chironomidae abundances;
- Percent contribution of dominant family;
- EPT index;
- Community similarity indices;
- Ratio of shredder functional feeding group to the total number of individuals collected (Plafkin *et al.* 1989).

The following provides a brief discussion of what each metric value and score reflects and how each RBA station compares to the background station. In addition, Table L–1 provides the taxa counts for all five RBA stations; Table L–2 lists the water quality parameters at each station; Table L–3 gives the habitat assessment scores for all five stations; and Table L–4 identifies the percent contribution of dominant family at each station. Finally, Table L–5 summaries the biological condition scores achieved by each station when compared to the background station.

L.4.1 Taxa Richness

The taxa richness metric reflects the health of an aquatic community by measuring the total number of families present. The taxa richness score would increase with an increase in the number of different families present, and would be indicative of increased water quality, habitat diversity, and habitat suitability. Exceptions to this rule would be a naturally unproductive areas such as the headwaters of a stream (low score) or an organically enriched area which may be polluted but have a high score (Plafkin *et al.* 1989).

The taxa richness scores for the four RBA stations were: six for Taylor Brook (TB–1), which was the reference station; 6 for the first station on Marlboro Brook (MB–1); 10 for the second station on Marlboro Brook (MB–2); and 10 for Honey Brook (HB–1). Thus, all of the stations had a score for taxa richness that was equal to or greater than the reference station.

L.4.2 Modified Family Biotic Index

The modified Family Biotic Index (FBI) metric is based upon Hilsenhof's tolerance value ranges for families of the benthic arthropod community (EPA 1989). Tolerance values are used to calculate this metric score and can range from 0 to 10 with the higher values representing the more tolerant families. The modification used in this metric was developed by the State of New York so that other benthic organisms besides arthropods could be included. The formula for calculating the FBI metrics value is as follows:

$$FBI = \sum \frac{x_i\ t_i}{n}$$

Where x_i = number of individuals within a taxon.
t_i = tolerance value of a taxon.
n = total number of organisms in a sample.

The FBI has only been evaluated for organic pollutants although it may also be applicable for true pollutants (Plafkin *et al.* 1989). The modified FBI matrix values calculated for the RBA stations are: 4.3 at TB–1; 4.5 at MB–1; 3.8 at MB–2; and 3.9 at HB–1. The modified FBI scores for the reference station (TB–1), MB–1, MB–2, and HB–1 are all six for biological conditions.

L.4.3 Ratio of Scraper and Filtering Collection Functional Feeding Groups

The scraper and filtering collector metric reflects the health of an aquatic community by comparing the dominance of a particular feeding type to the reference station. This metric is independent of taxonomy since some families may contain several different feeding groups. This metric is based more upon morphological and behavioral features of the aquatic organisms. Scrapers tend to increase with diatom abundance and decrease as filamentous algae increases. A loss of scrapers may indicate contamination or organic enrichment. Filter collectors attach to sites and feed on Fine Particulate Organic Matter (FPOM). Since certain types of toxicants attach to dissolved organic matter which then forms some of the FPOM, the filter collectors are usually the first feeding group affected due to their ingestion of FPOM and their sensitivity to toxicants (Plafkin, *et al.* 1989). The scraper and filtering collector metric scores for TB–1 (reference), MB–2, and HB–1 were all at six. The metric score for MB–1 was 3 suggesting an impairment of the health of the aquatic community that may be due to a contamination source affecting MB–1 or to the road crossing being close to the station.

L.4.4 Ratio of EPT and Chironomidae Abundances

The ratio of Ephemeroptera, Plecoptera, and Tricoptera (EPT) to Chironomidae abundance metric, reflects the health of the aquatic community by measuring its balance using these indicator orders (EPT) and family (Chironomidae). A healthy biotic community would be reflected when there is essentially an even distribution of all four groups. Since the EPT orders.are inherently more sensitive to habitat and water quality degradation than the much more tolerant Chironomidae family, any increase in dominance by Chironomids would be a strong indicator of an increase in a toxicant or another environmental stress. In particular, Chironomids become more dominant in percent community composition and relative abundance when heavy metal concentrations increase (Plafkin *et al.* 1989).

The four RBA stations and the reference station have EPT and Chironomidae abundance metric scores as follows:

- TB-1 (reference) had an EPT/Chironomidae value of 9.13 and a metric score of 6.
- MB-1 had an EPT/Chironomidae value of 0.23 and a metric score of 0.
- MB-2 had an EPT/Chironomidae value of 50.0 and a metric score of 6.
- HB-1 had a EPT/Chironomidae value of 4.54 and a metric score of 3.

The lower scores of MB-1 and HB-1 could be an indication of contamination, or enrichment, but also may be due to disturbances and effects from the roads because both stations were located just downstream from roads.

L.4.5 Percent Contribution of Dominant Family

The percent contribution of dominant family metric is used to assess the health of the aquatic community by comparing the numerically dominant family to the rest of the community at a family level. A community that is dominated by a large percentage of only a few families would be an indication of some environmental stress (Plafkin *et al.* 1989).

The lowest scores are assigned to RBA stations whenever a single family dominates the total number of organisms by more than 50 percent. Table L-5 shows the dominant families for each RBA station and indicates the percent contribution of the dominant family and the metric value score. All of the RBA stations except HB-1 had dominant families over 50 percent, with HB-1 at 46 percent.

L.4.6 EPT Index

The EPT index metric measures the health of the aquatic community by determining the total number of taxonomic families within the orders Ephemeroptera, Plecoptera, and

Tricoptera (EPT). These groups are generally considered to be the most sensitive to pollution. The EPT index should increase with better water quality. An exception to this would be naturally unproductive areas, such as headwaters, which would experience an EPT index increase in response to organic enrichment (Plafkin *et al.* 1989).

The EPT index valve and metric score for TB-1 (background) are 2 and 6, respectively; 2 and 6 at MB-1; 4 and 6 at MB-2; and at HB-1 they are 6 and 6, respectively. When compared to the reference station all of the RBA stations scored equally or higher which suggests that a healthy aquatic community, as measured by the EPT index, exists at each of the studied stations.

L.4.7 Community Similarity Indices

The community similarity indices metric offers several different ways to compare the RBA stations benthic communities to the reference station. The index chosen for this project's metric is the Community Loss Index, which measures the loss of benthic taxa between the reference station and an RBA station. This is an index of compositional dissimilarity; the index values increase as the degree of dissimilarity with the reference station increases. Therefore, if the reference station represents a typical, non-impacted stream community in the area, RBA stations may then be judged on their similarity or dissimilarity, in benthic family composition to the reference station (Plafkin *et al.* 1989).

The community loss index/community similarity index values for the three RBA stations when compared to the reference station (TB-1) are 0.50 for MB-1, 0.63 for MB-2, and 0.50 for HB-1. The metric scores are 3 for all these stations showing that they all have a moderate amount of dissimilarity from the reference station.

L.4.8 Ratio of Shredder Functional Feeding Group and Total Number of Individuals Collected

As with the scraper/filtering collector metric, the shredder functional feeding group metric is based on the functional feeding group concept and not on taxonomy. This metric allows evaluation of the health of aquatic communities based upon potential impairment as indicated by the CPOM-dependent shredder community. The shredder community is a good indicator of riparian zone impacts, since shredders feed on the CPOM (leaves) in the stream and are sensitive to the toxic effects when contaminants are absorbed into the CPOM. The effects of a toxicant on the shredders versus the filters depends upon the nature of the toxicant and the organic particle adsorption efficiency. Toxicants such as pesticides and herbicides tend to accumulate in CPOM thus affecting the shredders directly (Plafkin *et al.* 1989).

The ratio of shredder functional feeding groups to the total number of individuals collected is 0.87 at TB-1; 0.35 at MB-1, 0.00 at MB-2, and 0.77 at HB-1. The metric scores for TB-1 and HB-1 were 6 while MB-1 was 3 and MB-2 received a 0.

The low score for station MB–2 might be an indication of contamination such as pesticides and/or herbicides, but since this station was downstream of the Sudbury Annex property and near some residential areas, it is unclear where the source maybe originating. Additionally, the low score for MB–1 is most likely due to proximity and associated over-burden coming from an area of the base main roads.

L.4.9 Summary

The purpose of the RBA was to supplement chemical data for surface water and sediment with ecologically-based information. From this information, some limited inferences can be drawn regarding the potential effects of chemical contamination on benthic communities at the Sudbury Training Annex. Comparisons of benthic communities between the various locations and the reference location are critical to this evaluation. When examining the results of this RBA, however, it is important to note that comparisons of potentially contaminated locations to the off-site reference location are considered to be qualitative only. This is primarily a result of uncertainties associated with the potential impacts of an adjacent parking lot on the reference station.

Taking the total RBA metric values scores of the three on-site RBA stations and comparing them as a percent to the reference station total metric score, the following results were determined (Table 6-5):

MB-1	=	50 percent
MB-2	=	79 percent
HB-1	=	81 percent

According to the Rapid Bioassessment Protocols (Plafkin *et al.* 1989), any percentage above 79 percent when compared to the reference location, should be considered "non-impaired, with conditions equal to what can best be expected in the regional area with respect to stream size and habitat quality." RBA station MB-2 and HB-1 results indicate that the lower Marlboro Brook and Honey Brook systems appear to be non-impaired relative to the reference station, TB-1 (Taylor Brook). This suggests that contamination or other disturbances of these streams are no greater than for Taylor Brook at the reference point, TB-1. The result for station HB-1 is quantitatively supported by the results from the surface water and sediment sample taken at RBA station HB-1 at sample point E3-P11-D03. Sampling data at this point are described in the Site P11 section of this report (Section 2.2.3.7, Volume II), and indicate similar chemical concentrations in surface water and sediments at E3-P11-D03, and in samples taken at the reference station TB-1 at sample location E3-BCK-D01 (see Appendix J). However, it should be noted that when compared to the other sampling sites, the reference station exhibited an elevated conductivity reading.

The result for station MB-2 could not be quantitatively assessed as surface water/sediment samples were not taken at this RBA station. The nearest upstream samples

were taken at E3-P37-D03, and contained elevated pesticides and metals, but are located at least 1,200 feet upstream of RBA station MB-2 and above the nearby pond.

When percentage comparisons are between 29 and 72 percent of the background reference, these stations are considered to be "moderately impaired." This moderate impairment results from fewer species of the most intolerant forms and reductions in the EPT index. RBA station MB-1 had a percent value of 50 percent indicating the area may be experiencing some moderate impairment in relation to the reference station, TB-1. This qualitative result can be quantitatively supported by analytical data from the surface water/sediment sample taken at E3-A11-D01 (see Section 3.2.2.7). The analytical data showed this area to have the elevated levels of contaminants in surface water compared to the other RBA stations and the reference station. The RBA result may be the result of contamination from site-related sources, but may also be due to the stations close proximity to the road, potentially unproductive headwaters, and stream ponding on the upstream side of the road.

Although no significant bias is expected from the use of the Taylor Brook reference station in assessing the ecological health of the Sudbury watershed, the potential for underestimating or overestimating some of the metrics associated with the RBA is possible, given the proximity of this station to a parking lot.

L.5 REFERENCES

Cummins, K.W. and R.W. Merritt, 1984, *An Introduction to the Aquatic Insects of North America, Second Edition*, Kendoll/Hunt Publishing Company, Dubuque, Iowa, 722p.

Lehmkuhl, D.M., 1979, *How to Know the Aquatic Insects*, Wm. C. Brown Company Publishers, Dubuque, Iowa, 168p.

Plafkin, J.L., M.T. Barbour, R.D. Porter, S.K. Gross, and R.M. Hughs, Rapid Bioassessment 1989, *Protocols for use in stream and rivers, Benthic Macroinvertebrates and Fish*, EPA, EPA/440/4–89–001, 161p.

Ward, H.B. and G.C. Whipple, 1956, *Freshwater Biology, Second Edition*, John Wiles and Sons Inc., N.Y., 1248p.

Table L-1

RAPID BIOASSESSMENT TAXA COUNTS

Order and Family	Rapid Bioassessment Stations (Number of RBA Organisms/Number of CPOM Organisms)			
	TB-1	MB-1	MB-2	HB-1
Ephemeroptera				
Heptageniidae	0/0	0/0	16/4	0/0
Ephemerellidae	0/0	0/0	2/6	0/0
Trichoptera				
Psychomiidae	0/0	3/7	0/0	0/0
Hydropsychidae	70/0	0/0	80/11	2/0
Limnephilidae	3/2	7/5	2/0	38/26
Lepidostomatida	0/3	0/0	0/0	5/2
Molannidae	0/0	0/0	0/1	4/2
Glossosomatidae	0/0	0/0	0/0	1/1
Plecoptera				
Nemouridae	0/0	0/0	0/0	9/2
Diptera				
Tipulidae	4/1	43/0	2/17	13/6
Simuliidae	12/0	25/2	2/0	6/1
Chironomidae	8/2	43/0	2/17	13/6
Megaloptera				
Sialidae	0/0	1/0	3/0	4/0
Anisoptera				
Aeshnidae	0/1	0/0	0/0	0/2
Cordulegastridae	0/1	0/1	4/6	0/0
Amphopoda				
Gammaridae	10/42	0/5	7/0	0/12
Total Organisms	107/51	82/21	123/44	83/55
Total Number of Orders	3/4	3/4	6/4	4/5
Total Number of Families	6/6	6/6	10/6	10/10
Metric Value Score	6	6	6	6

Key: TB = Taylor Brook (background).
MB = Marlboro Brook.
HB = Honey Brook.

Source: Ecology and Environment, Inc. 1994.

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Table L-2

RAPID BIOASSESSMENT WATER QUALITY

Parameter	Rapid Bioassessment Stations			
	TB-1	MB-1	MB-2	HB-1
Temperature (°C)	15.5	13.4	12.8	15.5
Dissolved Oxygen (ppm)	5.82	5.0	3.6	4.8
pH (units)	5.82	5.25	4.04	6.34
Conductivity (μmhos)	179.4	26.9	14.4	26.8
Color (observed)	Clear	Clear	Brownish	Brownish
Turbidity (observed)	None	None	Slight	None

Key:

TB = Taylor Brook (background).
MB = Marlboro Brook.
HB = Honey Brook.

Source: Ecology and Environment, Inc. 1994.

Table L-3

RAPID BIOASSESSMENT STATION HABITAT ASSESSMENT SCORES

Parameter	Rapid Bioassessment Stations			
	TB-1	MB-1	MB-2	HB-1
Bottom substrate/available cover	10	10	15	15
Embeddedness	15	15	15	15
Flow	10	10	10	10
Channel alteration	7	7	7	11
Bottom scouring and deposition	7	11	7	11
Pool/riffle, run/bend ratio	7	7	7	11
Bank stability	5	5	5	8
Bank vegetative stability	8	8	10	8
Stream side cover	8	8	8	5
Score	77	81	84	94
Percent Comparison with TB-1 (background)	----	105	109	122

Key:

TB = Taylor Brook (background).
MB = Marlboro Brook.
HB = Honey Brook.

Source: Ecology and Environment, Inc. 1994.

Table L-4

PERCENT CONTRIBUTION OF DOMINANT FAMILY FOR RAPID BIOASSESSMENT STATIONS

Rapid Bioassessment Stations	Number of Organisms in RBA Sample	Dominant Family	Number of Organisms in Dominant Family	Percent Contribution of Dominant Family	Metric Value Score
TB-1	107	Hydropsychidae	70	65	0
MB-1	82	Chironomidae	43	52	0
MB-2	123	Hydropsychidae	80	65	0
HB-1	83	Limmephilidae	38	46	3

Key:

TB = Taylor Brook (background).
MB = Marlboro Brook.
HB = Honey Brook.

Source: Ecology and Environment, Inc. 1994.

Table L-5

SUMMARY OF BIOLOGICAL CONDITION SCORES

Metrics	Rapid Bioassessment Station (Biological Condition Scores)			
	TB-1 Background	MB-1	MB-2	HB-1
Taxa Richness	6	6	6	6
Family Biotic Index (Modified)	6	6	6	6
Ratio of Scrapers/Filter Collector	6	3	6	6
Ratio of EPT and Chironomid Abundance	6	0	6	3
Percent Contribution of Dominant Family	0	0	0	3
EPT Index	6	0	6	6
Community Loss Index	6	3	3	3
Ration of Shredders/Total	6	3	0	6
Total Score	42	21	33	39
Percent Comp to Ref Score	—	50	79	93

Key:

TB = Taylor Brook (Background).
MB = Marlboro Brook.
HB = Honey Brook.

Source: Ecology and Environment, Inc. 1994.

M

APPENDIX M

IRDMIS LEVEL 3 DATA

APPENDIX M

IRDMIS LEVEL 3 DATA

All IRDMIS Level 3 analytical data generated for the investigations at the Annex, including QA/QC data, are presented in electronic format on the enclosed diskette. The diskette contains data from E & E's first three sampling mobilizations in condensed-format files which will produce ASCII data tables when expanded. Instructions for accessing the analytical data tables and further information on the table formats are given in the file README.TXT.

The results for the supplemental sampling conducted in April 1994 for the RIs are contained in ASCII form. The text files are named APR_DATA.TXT for the actual data and APR_QC.TXT for the QC data. Access to these files can be done directly through a DOS utility.

Also contained in this appendix (in hard copy format only) are OHM soils data for Sites P11/P13. These data were used for the Risk Assessment.

FILE: README.TXT

The enclosed 3.5" diskette contains all IRDMIS level 3 data produced during the environmental investigations performed by Ecology and Environment, Inc. at the Fort Devens Sudbury Annex (prior to April 1994). These data are stored on this diskette in two self-extracting files: SD_DATA.EXE, and SD_QC.EXE. The first file contains the field sampling analytical data, and the second file contains the QA/QC analytical data. Data extracted from these files will be in ASCII format.

To extract the information from the files on this diskette, simply copy the file(s) to the PC which is to hold the information, and type the name of the file. For example, to obtain the ASCII QC data, copy the file SD_QC.EXE to the target PC and type:

```
C:\> SD_QC
```

Structure of SD_DATA.TXT (Analytical Data in ASCII Format):

Field Name	Columns	Type	Description
SA	1-3	Character 3	Study area
INST	4-5	Character 2	Installation
LAB	6-7	Character 2	Lab
LOT	8-11	Character 4	Lot identifier
SITE_TYPE	12-15	Character 4	Site type
MEDIA_TYPE	16-18	Character 3	Sample matrix
SITE_ID	19-28	Character 10	Site id
F_SAMPLE_N	29-36	Character 8	Field sample number
SAMP_DATE	37-47	Character 11	Sample date
DEPTH	48-52	Numeric 5,1	Depth (in feet)
METH	53-56	Character 4	Analytical method code
METH_MATRI	57	Character 1	Analytical matrix (solid or water)
TEST_NM	58-63	Character 6	Analyte code
MEAS_BOOL	64-65	Character 2	Measurement code (LT or ND or blank)
VALUE	66-79	Numeric 14,5	Analytical result
UNIT_MEAS	80-83	Character 4	Units
FLAG	84-87	Character 4	Data useability codes
WATERSHED	88-90	Character 2	Watershed (1A, 1B, 2, 3, 4, 5, 6)

Expanded file (SD_DATA.TXT) = 5,862,767 bytes

Structure of SD_QC.TXT (QC Data in ASCII Format):

Field Name	Columns	Type	Description
SA	1-3	Character 2	Study area (AOC)
INST	4-5	Character 2	Installation
LAB	6-7	Character 2	Lab
LOT	8-11	Character 4	Lot identifier
SITE_TYPE	12-15	Character 4	Site type
MEDIA_TYPE	16-18	Character 3	Sample matrix
SITE_ID	19-28	Character 10	Site id
F_SAMPLE_N	29-36	Character 8	Field sample number
SAMP_DATE	37-47	Character 11	Sample date
DEPTH	48-52	Numeric 5,1	Depth (in feet)
METH	53-56	Character 4	Analytical method code
METH_MATRI	57	Character 1	Analytical matrix (solid or water)
TEST_NM	58-63	Character 6	Analyte code
MEAS_BOOL	64-65	Character 2	Measurement code (LT or ND or blank)
VALUE	66-79	Numeric 14,5	Analytical result
QC_TYPE	80	Character 1	Type of QC sample
SPIKE	81-94	Numeric 14,5	Spike amount (if any)
UNIT_MEAS	95-98	Character 4	Units
FLAG	99-102	Character 4	Data useability codes
WATERSHED	103-105	Character 2	Watershed identifier

Expanded file (SD_QC.TXT) = 4,585,993 bytes

FILE: README.TXT

The enclosed 3.5" diskette contains all IRDMIS level 3 data produced during the April 1994 sampling mobilization performed by Ecology and Environment, Inc. at the Fort Devens Sudbury Annex. These data are stored on this diskette in two ASCII text files: APR_DATA.TXT, and APR_QC.TXT. The first file contains the field sampling analytical data, and the second file contains the QA/QC analytical data.

Structure of APR_DATA.TXT (Analytical Data in ASCII Format):

Field Name	Columns	Type	Description
SA	1-3	Character 3	Study area
INST	4-5	Character 2	Installation
LAB	6-7	Character 2	Lab
LOT	8-11	Character 4	Lot identifier
SITE_TYPE	12-15	Character 4	Site type
MEDIA_TYPE	16-18	Character 3	Sample matrix
SITE_ID	19-28	Character 10	Site id
F_SAMPLE_N	29-36	Character 8	Field sample number
SAMP_DATE	37-47	Character 11	Sample date
DEPTH	48-52	Numeric 5,1	Depth (in feet)
METH	53-56	Character 4	Analytical method code
METH_MATRI	57	Character 1	Analytical matrix (solid or water)
TEST_NM	58-63	Character 6	Analyte code
MEAS_BOOL	64-65	Character 2	Measurement code (LT or ND or blank)
VALUE	66-79	Numeric 14,5	Analytical result
UNIT_MEAS	80-83	Character 4	Units
FLAG	84-87	Character 4	Data useability codes
WATERSHED	88-90	Character 2	Watershed (1A, 1B, 2, 3, 4, 5, 6)

Structure of APR_QC.TXT (QC Data in ASCII Format):

Field Name	Columns	Type	Description
SA	1-3	Character 2	Study area (AOC)
INST	4-5	Character 2	Installation
LAB	6-7	Character 2	Lab
LOT	8-11	Character 4	Lot identifier
SITE_TYPE	12-15	Character 4	Site type
MEDIA_TYPE	16-18	Character 3	Sample matrix
SITE_ID	19-28	Character 10	Site id
F_SAMPLE_N	29-36	Character 8	Field sample number
SAMP_DATE	37-47	Character 11	Sample date
DEPTH	48-52	Numeric 5,1	Depth (in feet)
METH	53-56	Character 4	Analytical method code
METH_MATRI	57	Character 1	Analytical matrix (solid or water)
TEST_NM	58-63	Character 6	Analyte code
MEAS_BOOL	64-65	Character 2	Measurement code (LT or ND or blank)
VALUE	66-79	Numeric 14,5	Analytical result
QC_TYPE	80	Character 1	Type of QC sample
SPIKE	81-94	Numeric 14,5	Spike amount (if any)
UNIT_MEAS	95-98	Character 4	Units
FLAG	99-102	Character 4	Data useability codes
WATERSHED	103-105	Character 2	Watershed identifier

Table 7-69
Area P11
Summary of Positive Detections
Soil (ug/g)

Site ID		OHM-P11-32		OHM-P11-33		OHM-P11-34		P11TPA		P11TPA
Field Sample Number		P11SB32		P11SB33		P11SB34		P11TPA1		DUPTP02A
Sample Date		03-Mar-92		03-Mar-92		04-Mar-92		10-Dec-91		10-Dec-91
Depth (ft)		6.0		4.0		2.0		2.0		2.0
Pesticides/PCBs										
2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane(DDT)		ND		ND		ND		ND		ND
2,2-Bis(p-chlorophenyl)-1,1-dichloroethane(DDD)		ND		ND		ND		ND		ND
2,2-Bis(p-chlorophenyl)-1,1-dichloroethene(DDE)		ND		ND		ND		ND		ND
BNAs										
Bis (2-ethylhexyl) phthalate		ND		ND	B	0.603	B	0.7	B	0.74
Di-N-butyl phthalate	B	0.715	B	0.477	B	0.919	B	0.51	B	0.25
UNK510		ND		ND		ND	B	2		ND
UNK529		ND		ND		ND		ND		ND
UNK608		ND	B	5.97		ND		ND		ND
UNK609		ND		ND		9.85		ND		ND
UNK623		1.19		1.19		ND		ND		ND
UNK624		ND		ND		ND		ND		ND
UNK627		ND		ND		ND		ND		ND
UNK629		ND		ND		ND		ND		ND
UNK634		ND		ND		ND		ND		ND
UNK635	B	9.54	B	9.55	B	7.66		ND		ND
UNK641		2.38		ND		2.19		ND		ND
UNK643		ND		ND		ND		ND		ND
UNK645		ND		2.39		2.19		ND		ND
UNK646	B	3.58	B	3.58	B	3.28		ND		ND
UNK654		ND		ND		ND		ND		1
UNK656		1.19		1.19		1.09		ND		ND
UNK660		ND		1.19		ND		ND		ND
UNK665		1.19		2.39		1.09		ND		ND

Table 7-69
Area P11
Summary of Positive Detections
Soil (ug/g)

Site ID	OHM-P11-32	OHM-P11-33	OHM-P11-34		P11TPA	P11TPA
Field Sample Number	P11SB32	P11SB33	P11SB34		P11TPA1	DUPTP02A
Sample Date	03-Mar-92	03-Mar-92	04-Mar-92		10-Dec-91	10-Dec-91
Depth (ft)	6.0	4.0	2.0		2.0	2.0
Volatile Organics						
UNK022	ND	0.024	ND		ND	ND
UNK023	ND	ND	0.033		ND	ND
UNK024	0.048	ND	ND		ND	ND
UNK148	ND	ND	ND		ND	ND
UNK149	0.001	ND	0.001		ND	ND
Organic Carbon						
Total Organic Carbon	726	378	468		ND	ND
Metals						
Aluminum	5100	4800	8800		4500	4600
Aluminum	NA	NA	NA	D	4000	NA
Arsenic	4.83	4.04	5.74		10	9.3
Arsenic	NA	NA	NA	D	7.8	NA
Barium	ND	ND	12.3		13	12.6
Beryllium	ND	ND	0.283		ND	ND
Cadmium	0.706	ND	ND		7.72	7.91
Cadmium	NA	NA	NA	D	6.39	NA
Calcium	ND	ND	ND	D	467	443
Chromium	12.4	10.1	12.5		8.73	8.76
Chromium	NA	NA	NA	D	7.36	NA
Cobalt	ND	ND	3.29		ND	ND
Copper	16.1	4.94	6.78		4.58	4.87
Copper	NA	NA	NA	D	4.19	NA
Iron	16000	8200	9600		6100	6200
Iron	NA	NA	NA	D	4900	NA
Lead	2.82	2.35	3.6		3.11	3.08
Lead	NA	NA	NA	D	2.88	NA
Magnesium	1780	1810	2030		1220	1220
Magnesium	NA	NA	NA	D	993	NA
Manganese	70	75.7	120		56.2	55.4
Manganese	NA	NA	NA	D	44.9	NA
Mercury	ND	ND	ND		ND	ND

Table 7-69
Area P11
Summary of Positive Detections
Soil (ug/g)

Site ID	OHM-P11-32	OHM-P11-33	OHM-P11-34		P11TPA	P11TPA
Field Sample Number	P11SB32	P11SB33	P11SB34		P11TPA1	DUPTP02A
Sample Date	03-Mar-92	03-Mar-92	04-Mar-92		10-Dec-91	10-Dec-91
Depth (ft)	6.0	4.0	2.0		2.0	2.0
Nickel	6.9	7.21	8.49		3.72	3.96
Nickel	NA	NA	NA	D	2.87	NA
Potassium	1050	938	770		900	877
Potassium	NA	NA	NA	D	800	NA
Vanadium	13.4	9.52	13.3		8.22	8.41
Vanadium	NA	NA	NA	D	7.03	NA
Zinc	18.2	14.7	17.7		13.4	11.9
Zinc	NA	NA	NA	D	9.61	NA

Table 7-69
Area P11
Summary of Positive Detections
Soil (ug/g)

Site ID	P11TPA		P11TPB	P11TPB	P11TPB		P11CD1
Field Sample Number	P11TPA2		P11TPB1	P11TPB2	P11TPB3		P11CD1A
Sample Date	10-Dec-91		10-Dec-91	10-Dec-91	10-Dec-91		18-May-92
Depth (ft)	4.0		2.0	4.0	6.0		0.0
Pesticides/PCBs							
2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane(DDT)	NA		ND	NA	NA		0.035
2,2-Bis(p-chlorophenyl)-1,1-dichloroethane(DDD)	NA		ND	NA	NA		0.035
2,2-Bis(p-chlorophenyl)-1,1-dichloroethene(DDE)	NA		ND	NA	NA		0.059
BNAs							
Bis (2-ethylhexyl) phthalate	NA	B	0.64	NA	NA		0.56
Di-N-butyl phthalate	NA	B	0.37	NA	NA	B	1.1
UNK510	NA		ND	NA	NA		ND
UNK529	NA		ND	NA	NA		30
UNK608	NA		ND	NA	NA		ND
UNK609	NA		ND	NA	NA		ND
UNK623	NA		ND	NA	NA		ND
UNK624	NA		ND	NA	NA	B	4
UNK627	NA		ND	NA	NA		10
UNK629	NA		ND	NA	NA	B	10
UNK634	NA		ND	NA	NA		1
UNK635	NA		ND	NA	NA		ND
UNK641	NA		ND	NA	NA		ND
UNK643	NA		ND	NA	NA		1
UNK645	NA		ND	NA	NA		ND
UNK646	NA		ND	NA	NA		ND
UNK654	NA		1	NA	NA		ND
UNK656	NA		ND	NA	NA		ND
UNK660	NA		ND	NA	NA		ND
UNK665	NA		ND	NA	NA		ND

Table 7-69
Area P11
Summary of Positive Detections
Soil (ug/g)

Site ID	P11TPA	P11TPB	P11TPB	P11TPB		P11CD1
Field Sample Number	P11TPA2	P11TPB1	P11TPB2	P11TPB3		P11CD1A
Sample Date	10-Dec-91	10-Dec-91	10-Dec-91	10-Dec-91		18-May-92
Depth (ft)	4.0	2.0	4.0	6.0		0.0
Volatile Organics						
UNK022	ND	ND	ND	ND		ND
UNK023	ND	ND	ND	ND		ND
UNK024	ND	ND	ND	ND		ND
UNK148	ND	ND	ND	ND	B	0.01
UNK149	ND	ND	ND	ND		ND
Organic Carbon						
Total Organic Carbon	NA	ND	NA	NA		ND
Metals						
Aluminum	NA	5400	NA	NA		8300
Aluminum	NA	NA	NA	NA		NA
Arsenic	NA	3.54	NA	NA		4.36
Arsenic	NA	NA	NA	NA		NA
Barium	NA	28.3	NA	NA		39.6
Beryllium	NA	NA	NA	NA		NA
Cadmium	NA	13.1	NA	NA		0.792
Cadmium	NA	NA	NA	NA		NA
Calcium	NA	464	NA	NA		ND
Chromium	NA	13.1	NA	NA		8.2
Chromium	NA	NA	NA	NA		NA
Cobalt -	NA	NA	NA	NA		ND
Copper	NA	10.3	NA	NA		3.42
Copper	NA	NA	NA	NA		NA
Iron	NA	11000	NA	NA		9800
Iron	NA	NA	NA	NA		NA
Lead	NA	3.59	NA	NA		24
Lead	NA	NA	NA	NA		NA
Magnesium	NA	2180	NA	NA		599
Magnesium	NA	NA	NA	NA		NA
Manganese	NA	96.1	NA	NA		31.3
Manganese	NA	NA	NA	NA		NA
Mercury	NA	0.0924	NA	NA		ND

Table 7-69
Area P11
Summary of Positive Detections
Soil (ug/g)

Site ID	P11TPA	P11TPB	P11TPB	P11TPB	P11CD1
Field Sample Number	P11TPA2	P11TPB1	P11TPB2	P11TPB3	P11CD1A
Sample Date	10-Dec-91	10-Dec-91	10-Dec-91	10-Dec-91	18-May-92
Depth (ft)	4.0	2.0	4.0	6.0	0.0
Nickel	NA	5.42	NA	NA	2.55
Nickel	NA	NA	NA	NA	NA
Potassium	NA	2130	NA	NA	263
Potassium	NA	NA	NA	NA	NA
Vanadium	NA	16	NA	NA	11.8
Vanadium	NA	NA	NA	NA	NA
Zinc	NA	23.4	NA	NA	ND
Zinc	NA	NA	NA	NA	NA

Table 7-72
Area P13
Summary of Positive Detections
Soils (ug/g)

Site ID	P13CD1	P13CD2	P13CD3	P13SO1	P13SO2	P13SO3
Field Sample Number	P13CD1A	P13CD2A	P13CD3A	P13SO1A	P13SO2A	P13SO3A
Sample Date	18-May-92	18-May-92	18-May-92	20-Apr-92	20-Apr-92	20-Apr-92
Depth (ft)	0.0	0.0	0.0	0.0	0.0	0.0
UNK600	ND	ND	ND	89.7	ND	ND
UNK601	ND	ND	ND	ND	ND	ND
UNK605	ND	ND	ND	29.9	ND	ND
UNK606	ND	ND	ND	ND	ND	ND
UNK609	ND	ND	ND	ND	ND	ND
UNK614	ND	ND	ND	ND	10.7	ND
UNK618	ND	ND	ND	ND	ND	ND
UNK619	ND	ND	ND	ND	ND	10.7
UNK623	ND	ND	ND	ND	ND	ND
UNK624	ND	B 2	B 2	ND	ND	ND
UNK629	ND	B 10	ND	ND	ND	ND
UNK632	ND	ND	ND	ND	ND	ND
UNK638	ND	ND	ND	ND	ND	ND
UNK643	ND	ND	2	ND	ND	ND
UNK647	ND	ND	1	ND	ND	ND
UNK649	ND	ND	1	ND	ND	ND
UNK652	ND	ND	ND	ND	ND	ND
UNK654	ND	ND	1	ND	ND	ND
UNK657	ND	ND	1	ND	ND	ND
UNK666	ND	10	ND	ND	ND	ND
UNK669	ND	2	ND	ND	ND	ND
UNK673	ND	4	ND	ND	ND	ND
Volatile Organics						
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND	ND	ND
Methylethyl ketone	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND
UNK021	ND	ND	ND	0.03	0.011	ND
UNK148	0.01	0.01	0.01	ND	ND	ND
UNK149	ND	ND	ND	ND	ND	ND
UNK152	ND	ND	ND	0.015	ND	ND

Table 7-72
Area P13
Summary of Positive Detections
Soils (ug/g)

Site ID	P13CD1	P13CD2	P13CD3	P13SO1	P13SO2	P13SO3
Field Sample Number	P13CD1A	P13CD2A	P13CD3A	P13SO1A	P13SO2A	P13SO3A
Sample Date	18-May-92	18-May-92	18-May-92	20-Apr-92	20-Apr-92	20-Apr-92
Depth (ft)	0.0	0.0	0.0	0.0	0.0	0.0
Pesticides/PCBs						
2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane(DDT)	0.226	0.6	0.09	0.25	0.0998	0.0235
2,2-Bis(p-chlorophenyl)-1,1-dichloroethane(DDD)	ND	ND	ND	0.59	ND	ND
2,2-Bis(p-chlorophenyl)-1,1-dichloroethene(DDE)	0.075	0.4	0.076	0.35	ND	ND
alpha-Chlordane	ND	ND	ND	ND	ND	ND
gamma-Chlordane	ND	ND	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	0.16	ND	ND
beta-Endosulfan	ND	ND	ND	0.29	ND	ND
Dieldrin	ND	ND	ND	ND	ND	ND
PCB 1254	ND	ND	ND	ND	ND	ND
PCB 1260	ND	ND	ND	ND	ND	ND
Explosives						
2-Nitrotoluene	ND	ND	ND	ND	ND	ND
BNAs						
2-Methylnaphthalene	ND	ND	ND	2.61	ND	ND
Acenaphthene	ND	ND	ND	0.747	ND	ND
Bis (2-ethylhexyl) phthalate	ND	ND	1.6	18.3	ND	ND
Chrysene	ND	ND	ND	2.42	ND	ND
Di-N-butyl phthalate	ND	B 0.99	B 0.63	B 2.99	B 1.07	B 0.534
Di-N-octyl phthalate	ND	ND	ND	1.49	ND	ND
Phenanthrene	ND	ND	ND	2.11	ND	ND
Pyrene	ND	ND	ND	3.54	ND	ND
UNK528	ND	20	20	ND	ND	ND
UNK529	ND	ND	ND	59.8	42.7	32
UNK530	10	ND	ND	ND	ND	ND
UNK574	ND	ND	ND	14.9	ND	ND
UNK578	ND	ND	ND	14.9	ND	ND
UNK580	ND	ND	ND	29.9	ND	ND
UNK591	ND	ND	ND	44.8	ND	ND
UNK594	ND	ND	ND	29.9	ND	ND
UNK595	ND	ND	ND	120	ND	ND

Table 7-72
Area P13
Summary of Positive Detections
Soils (ug/g)

Site ID	P13CD1	P13CD2	P13CD3	P13SO1	P13SO2	P13SO3
Field Sample Number	P13CD1A	P13CD2A	P13CD3A	P13SO1A	P13SO2A	P13SO3A
Sample Date	18-May-92	18-May-92	18-May-92	20-Apr-92	20-Apr-92	20-Apr-92
Depth (ft)	0.0	0.0	0.0	0.0	0.0	0.0
Metals						
Aluminum	5800	8400	10000	14000	7400	7900
Aluminum	NA	NA	NA	NA	NA	NA
Arsenic	7.1	5.26	8.7	6.5	5.1	6.1
Arsenic	NA	NA	NA	NA	NA	NA
Barium	14.4	19.8	21.7	252	28.5	28.6
Barium	NA	NA	NA	NA	NA	NA
Beryllium	ND	ND	ND	0.427	ND	ND
Beryllium	NA	NA	NA	NA	NA	NA
Cadmium	0.681	0.99	0.835	14.2	0.492	0.569
Cadmium	NA	NA	NA	NA	NA	NA
Calcium	418	ND	503	6030	608	512
Calcium	NA	NA	NA	NA	NA	NA
Chromium	9.91	11.9	11.9	42.7	16.2	15.3
Chromium	NA	NA	NA	NA	NA	NA
Cobalt	ND	2.65	ND	7.08	3.29	3.84
Copper	5.01	6.52	5.85	98.1	15.8	17.2
Copper	NA	NA	NA	NA	NA	NA
Iron	7300	8800	9300	24000	12000	11000
Iron	NA	NA	NA	NA	NA	NA
Lead	33	28	32	160	55	34
Lead	NA	NA	NA	NA	NA	NA
Magnesium	1560	1620	1260	8260	2900	2670
Magnesium	NA	NA	NA	NA	NA	NA
Manganese	81.8	97.9	106	360	140	170
Manganese	NA	NA	NA	NA	NA	NA
Mercury	ND	ND	0.11	ND	ND	ND
Mercury	NA	NA	NA	NA	NA	NA
Nickel	5.18	5.61	5.2	23.5	9.4	8.72
Nickel	NA	NA	NA	NA	NA	NA
Potassium	721	951	447	4340	2010	2080
Potassium	NA	NA	NA	NA	NA	NA
Sodium	ND	ND	ND	577	ND	ND
Vanadium	11.3	15.9	16.4	41.3	20.8	18.6

Table 7-72
Area P13
Summary of Positive Detections
Soils (ug/g)

Site ID	P13CD1	P13CD2	P13CD3	P13SO1	P13SO2	P13SO3
Field Sample Number	P13CD1A	P13CD2A	P13CD3A	P13SO1A	P13SO2A	P13SO3A
Sample Date	18-May-92	18-May-92	18-May-92	20-Apr-92	20-Apr-92	20-Apr-92
Depth (ft)	0.0	0.0	0.0	0.0	0.0	0.0
Vanadium	NA	NA	NA	NA	NA	NA
Zinc	73.2	24.9	21.5	910	28.7	32.4
Zinc	NA	NA	NA	NA	NA	NA
TPH	NA	NA	NA	NA	NA	NA
TPH	NA	NA	NA	NA	NA	NA

Table 7-72
Area P13
Summary of Positive Detections
Soils (ug/g)

Site ID	P13CA1	P13CA2	P13CA3	P13CA4	P13CA5	P13CA5
Field Sample Number	P13CA1A	P13CA2A	P13CA3A	P13CA4A	DUPCA01A	P13CA5A
Sample Date	16-Oct-1992	16-Oct-1992	16-Oct-1992	16-Oct-1992	16-Oct-1992	16-Oct-1992
Depth (ft)	0.0	0.0	0.0	0.0	0.0	0.0
Pesticides/PCBs						
2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane(DDT)	0.0149	0.0622	0.146	0.0284	D 0.75	0.222
2,2-Bis(p-chlorophenyl)-1,1-dichloroethane(DDD)	ND	ND	ND	ND	ND	ND
2,2-Bis(p-chlorophenyl)-1,1-dichloroethene(DDE)	ND	ND	ND	ND	D 0.025	ND
alpha-Chlordane	ND	ND	ND	ND	D 0.23	0.14
gamma-Chlordane	ND	ND	ND	ND	D 0.17	0.157
Heptachlor	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND	D 0.0404	0.0346
beta-Endosulfan	ND	ND	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND	ND	ND
PCB 1254	ND	ND	ND	ND	ND	ND
PCB 1260	ND	ND	0.455	ND	ND	ND
Explosives						
2-Nitrotoluene	ND	ND	ND	ND	ND	U 1.44
BNAs						
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND
Bis (2-ethylhexyl) phthalate	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND
Di-N-butyl phthalate	ND	ND	ND	B 0.43	ND	ND
Di-N-octyl phthalate	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND
UNK528	B 5	B 4	ND	B 4	ND	B 6
UNK529	ND	ND	9	ND	10	ND
UNK530	ND	ND	ND	ND	ND	ND
UNK574	ND	ND	ND	ND	ND	ND
UNK578	ND	ND	ND	ND	ND	ND
UNK580	ND	ND	ND	ND	ND	ND
UNK591	ND	ND	ND	ND	ND	ND
UNK594	ND	ND	ND	ND	ND	ND
UNK595	ND	ND	ND	ND	2	3

Table 7-72
Area P13
Summary of Positive Detections
Soils (ug/g)

Site ID		P13CA1		P13CA2		P13CA3		P13CA4		P13CA5		P13CA5
Field Sample Number		P13CA1A		P13CA2A		P13CA3A		P13CA4A		DUPCA01A		P13CA5A
Sample Date		16-Oct-1992		16-Oct-1992		16-Oct-1992		16-Oct-1992		16-Oct-1992		16-Oct-1992
Depth (ft)		0.0		0.0		0.0		0.0		0.0		0.0
UNK600		ND		ND		ND		ND		ND		1
UNK601		ND		ND		ND		ND		1		2
UNK605		ND		ND		ND		ND		ND		ND
UNK606		ND		ND		ND		ND		ND		1
UNK609		ND		ND		ND		ND		ND		ND
UNK614	B	10	B	10	B	10	B	9	B	10	B	10
UNK618		ND		ND		ND		ND		ND		ND
UNK619		ND		ND		ND		ND		ND		ND
UNK623	B	4	B	4	B	5		4		ND	B	2
UNK624	B	7	B	6	B	8	B	8	B	8	B	6
UNK629		ND		ND		ND		ND		ND		ND
UNK632	B	2	B	2	B	2		2		ND		ND
UNK638		ND		ND		ND		ND		ND		ND
UNK643		ND		ND		ND		ND		ND		ND
UNK647		ND		ND		ND		ND		ND		ND
UNK649		ND		ND		ND		ND		ND		ND
UNK652		ND		ND		ND		ND		ND		ND
UNK654		ND		ND		ND		ND		ND		ND
UNK657		ND		ND		ND		ND		ND		ND
UNK666		3		ND		ND		10		ND		ND
UNK669		ND		ND		ND		ND		ND		ND
UNK673		ND		ND		ND		ND		ND		ND
Volatile Organics												
1,1,1-Trichloroethane		ND		ND		ND		ND		0.0017		ND
Methylene chloride		ND		ND		ND		ND		ND		ND
Methylethyl ketone		ND		ND		ND		ND		ND		0.0031
Toluene		ND		0.0039		ND		ND		ND		ND
Trichlorofluoromethane		ND		ND		ND		ND		ND		ND
UNK021		ND		ND		ND		ND		ND		ND
UNK148		ND		ND		ND		ND		ND		0.01
UNK149		ND		ND		ND	B	0.01	B	0.01		ND
UNK152		ND		ND		ND		ND		ND		ND

Table 7-72
Area P13
Summary of Positive Detections
Soils (ug/g)

Site ID	P13CA1	P13CA2	P13CA3	P13CA4	P13CA5		P13CA5
Field Sample Number	P13CA1A	P13CA2A	P13CA3A	P13CA4A	DUPCA01A		P13CA5A
Sample Date	16-Oct-1992	16-Oct-1992	16-Oct-1992	16-Oct-1992	16-Oct-1992		16-Oct-1992
Depth (ft)	0.0	0.0	0.0	0.0	0.0		0.0
Metals							
Aluminum	11000	7000	8300	8600	12000		13000
Aluminum	NA	NA	NA	NA	NA	D	13000
Arsenic	9.3	9.8	11	9	7.2		8
Arsenic	NA	NA	NA	NA	NA	D	8
Barium	22.7	24.3	34.3	18.7	51.5		40.7
Barium	NA	NA	NA	NA	NA	D	40.2
Beryllium	0.36	ND	ND	ND	0.317		0.398
Beryllium	NA	NA	NA	NA	NA		0.42
Cadmium	2.72	1.44	1.9	1.86	2.12		1.91
Cadmium	NA	NA	NA	NA	NA	D	1.74
Calcium	565	492	506	468	1780		4090
Calcium	NA	NA	NA	NA	NA	D	2880
Chromium	20.8	14.8	18.6	17.3	15.6		17.8
Chromium	NA	NA	NA	NA	NA		15.6
Cobalt	10.7	4.37	6.66	5.83	3		2.98
Copper	14.6	11.6	13.7	12	14.5		17.8
Copper	NA	NA	NA	NA	NA	D	15.6
Iron	17000	11000	14000	12000	11000		13000
Iron	NA	NA	NA	NA	NA	D	12000
Lead	26	98	140	18	130		92
Lead	NA	NA	NA	NA	NA	D	73
Magnesium	4200	2310	3150	3070	1670		1920
Magnesium	NA	NA	NA	NA	NA	D	1800
Manganese	460	240	380	290	180		200
Manganese	NA	NA	NA	NA	NA	D	170
Mercury	ND	ND	ND	ND	0.106		0.082
Mercury	NA	NA	NA	NA	NA	D	0.0749
Nickel	22.3	11.3	15.7	15.1	8.84		9.01
Nickel	NA	NA	NA	NA	NA	D	8.35
Potassium	1470	1130	1280	1160	562		758
Potassium	NA	NA	NA	NA	NA	D	690
Sodium	ND	ND	ND	ND	ND		ND
Vanadium	19.5	16.8	15.7	16.5	21		23

Table 7-72
Area P13
Summary of Positive Detections
Soils (ug/g)

Site ID	P13CA1	P13CA2	P13CA3	P13CA4	P13CA5		P13CA5
Field Sample Number	P13CA1A	P13CA2A	P13CA3A	P13CA4A	DUPCA01A		P13CA5A
Sample Date	16-Oct-1992	16-Oct-1992	16-Oct-1992	16-Oct-1992	16-Oct-1992		16-Oct-1992
Depth (ft)	0.0	0.0	0.0	0.0	0.0		0.0
Vanadium	NA	NA	NA	NA	NA	D	21.6
Zinc	43.9	39.7	31.8	27.1	180		170
Zinc	NA	NA	NA	NA	NA	D	78.5
TPH	NA	NA	NA	NA	NA		NA
TPH	NA	NA	NA	NA	NA		NA

Table 7-72
Area P13
Summary of Positive Detections
Soils (ug/g)

Site ID Field Sample Number Sample Date Depth (ft)	P13CA6 P13CA6A 16-Oct-1992 0.0	P13CA7 P13CA7A 16-Oct-1992 0.0	P13CA8 P13CA8A 16-Oct-1992	P13CU1 P13CU1A 17-Nov-1992 10.0	P13CU2 DUPCU01A 17-nov-1992 8.0	P13CU2 P13CU2A 17-Nov-1992 8.0
UNK600	ND	ND	ND	ND	ND	ND
UNK601	2	ND	ND	ND	ND	ND
UNK605	ND	ND	ND	ND	ND	ND
UNK606	ND	ND	ND	ND	ND	ND
UNK609	ND	ND	2	ND	ND	ND
UNK614	ND	ND	B 10	ND	ND	ND
UNK618	ND	ND	6	ND	1	ND
UNK619	ND	ND	ND	ND	ND	ND
UNK623	ND	ND	B 8	ND	ND	ND
UNK624	ND	ND	B 10	ND	ND	ND
UNK629	ND	ND	ND	ND	ND	ND
UNK632	ND	ND	B 4	ND	ND	ND
UNK638	ND	ND	ND	ND	2	ND
UNK643	ND	ND	ND	ND	ND	ND
UNK647	ND	ND	ND	ND	ND	ND
UNK649	ND	ND	ND	ND	ND	ND
UNK652	ND	ND	ND	2	ND	ND
UNK654	ND	ND	ND	ND	ND	ND
UNK657	ND	ND	ND	ND	ND	ND
UNK666	ND	ND	ND	ND	ND	ND
UNK669	ND	ND	ND	ND	ND	ND
UNK673	ND	ND	ND	ND	ND	ND
Volatile Organics						
1,1,1-Trichloroethane	0.0016	ND	ND	ND	ND	NA
Methylene chloride	ND	ND	0.014	ND	ND	NA
Methylethyl ketone	ND	ND	ND	ND	ND	NA
Toluene	ND	ND	ND	0.0023	ND	NA
Trichlorofluoromethane	0.012	ND	ND	ND	ND	NA
UNK021	ND	ND	ND	ND	ND	NA
UNK148	ND	ND	ND	ND	ND	NA
UNK149	ND	B 0.01	B 0.01	ND	ND	NA
UNK152	ND	ND	ND	ND	ND	NA

Table 7-72
Area P13
Summary of Positive Detections
Soils (ug/g)

Site ID	P13CA6	P13CA7	P13CA8	P13CU1	P13CU2	P13CU2
Field Sample Number	P13CA6A	P13CA7A	P13CA8A	P13CU1A	DUPCU01A	P13CU2A
Sample Date	16-Oct-1992	16-Oct-1992	16-Oct-1992	17-Nov-1992	17-nov-1992	17-Nov-1992
Depth (ft)	0.0	0.0		10.0	8.0	8.0
Pesticides/PCBs						
2,2-Bis(p-chlorophenyl)-1,1,1-trichloroethane(DDT)	0.68	0.4	1.1	ND	ND	ND
2,2-Bis(p-chlorophenyl)-1,1-dichloroethane(DDD)	ND	ND	0.26	ND	ND	ND
2,2-Bis(p-chlorophenyl)-1,1-dichloroethene(DDE)	0.0604	0.84	0.233	ND	ND	ND
alpha-Chlordane	0.11	0.35	0.0435	ND	ND	ND
gamma-Chlordane	0.103	0.46	0.0476	ND	ND	ND
Heptachlor	ND	0.0202	ND	ND	ND	ND
Heptachlor epoxide	ND	0.0866	0.0146	ND	ND	ND
beta-Endosulfan	ND	ND	ND	ND	ND	ND
Dieldrin	ND	0.0413	ND	ND	ND	ND
PCB 1254	ND	3.4	0.61	ND	ND	ND
PCB 1260	ND	ND	ND	ND	ND	ND
Explosives						
2-Nitrotoluene	ND	ND	ND	ND	ND	ND
BNAs						
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND
Bis (2-ethylhexyl) phthalate	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND
Di-N-butyl phthalate	ND	ND	ND	B 0.44	B 0.51	ND
Di-N-octyl phthalate	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND
UNK528	ND	ND	B 5	ND	ND	ND
UNK529	ND	ND	ND	ND	ND	ND
UNK530	ND	ND	ND	ND	ND	ND
UNK574	ND	ND	ND	ND	ND	ND
UNK578	ND	ND	ND	ND	ND	ND
UNK580	ND	ND	ND	ND	ND	ND
UNK591	ND	ND	ND	ND	ND	ND
UNK594	ND	ND	ND	ND	ND	ND
UNK595	2	ND	ND	ND	ND	ND

Table 7-72
Area P13
Summary of Positive Detections
Soils (ug/g)

Site ID	P13CA6	P13CA7	P13CA8	P13CU1	P13CU2		P13CU2
Field Sample Number	P13CA6A	P13CA7A	P13CA8A	P13CU1A	DUPCU01A		P13CU2A
Sample Date	16-Oct-1992	16-Oct-1992	16-Oct-1992	17-Nov-1992	17-nov-1992		17-Nov-1992
Depth (ft)	0.0	0.0		10.0	8.0		8.0
Metals							
Aluminum	7900	10000	10000	5500	7700		6500
Aluminum	NA	NA	NA	NA	NA	D	6500
Arsenic	6.2	7.8	6.9	3.74	6.46		8.8
Arsenic	NA	NA	NA	NA	NA	D	8.8
Barium	20	28.2	16.9	20.5	20.2		17.9
Barium	NA	NA	NA	NA	NA	D	16.9
Beryllium	ND	ND	ND	ND	ND		ND
Beryllium	NA	NA	NA	NA	NA		NA
Cadmium	4.28	2.43	1.62	0.586	0.62	D	0.758
Cadmium	NA	NA	NA	NA	NA		0.659
Calcium	612	2160	546	517	789		805
Calcium	NA	NA	NA	NA	NA	D	779
Chromium	13.6	19.7	21.1	10	10.5		9.64
Chromium	NA	NA	NA	NA	NA	D	9.8
Cobalt	3.71	3.96	3.54	ND	ND		ND
Copper	18.7	550	49	6.6	6.64		6.46
Copper	NA	NA	NA	NA	NA	D	5.71
Iron	11000	12000	12000	8100	8000		7600
Iron	NA	NA	NA	NA	NA	D	7100
Lead	89	180	58	2.86	7.3	D	4.6
Lead	NA	NA	NA	NA	NA		5
Magnesium	1870	1850	2350	2030	1830	D	1650
Magnesium	NA	NA	NA	NA	NA		1720
Manganese	100	170	130	99	110		101
Manganese	NA	NA	NA	NA	NA	D	87.2
Mercury	ND	0.426	0.249	ND	ND		ND
Mercury	NA	NA	NA	NA	NA		ND
Nickel	9.46	30.9	20.4	6.17	6.76		5.88
Nickel	NA	NA	NA	NA	NA	D	59.5
Potassium	827	522	712	1330	1010		944
Potassium	NA	NA	NA	NA	NA	D	955
Sodium	ND	ND	ND	ND	ND		ND
Vanadium	15.3	109	12.4	11.6	11.8		10.6

Table 7-72
Area P13
Summary of Positive Detections
Soils (ug/g)

Site ID	P13CA6	P13CA7	P13CA8	P13CU1	P13CU2	P13CU2	
Field Sample Number	P13CA6A	P13CA7A	P13CA8A	P13CU1A	DUPCU01A		P13CU2A
Sample Date	16-Oct-1992	16-Oct-1992	16-Oct-1992	17-Nov-1992	17-nov-1992		17-Nov-1992
Depth (ft)	0.0	0.0		10.0	8.0		8.0
Vanadium	NA	NA	NA	NA	NA	D	10.8
Zinc	160	330	78.7	13.9	16		14.3
Zinc	NA	NA	NA	NA	NA	D	13.1
TPH	NA	NA	NA	ND	ND		13
TPH	NA	NA	NA	NA	NA		10.7

N

APPENDIX N

WATER QUALITY PARAMETERS

APPENDIX N

WATER QUALITY PARAMETERS

This Appendix presents the physical characteristics measured in the field to assess the water quality of streams, ponds, and groundwater monitoring wells prior to sampling. The following characteristics were measured using a Horiba U-10 Water Quality Meter: pH, conductivity, turbidity, dissolved oxygen (DO), and temperature. In some instances it was not possible to measure certain water quality parameters due to equipment failure caused by adverse field/weather conditions. These instances are noted on the tables.

TABLE N-1

WATER QUALITY PARAMETERS FOR SURFACE WATER SAMPLES

Sample Location	Date	pH	Conductivity (μS/cm)	Turbidity (NTUs)	Dissolved Oxygen (μg/L)	Temp. (C°)
Watershed 1B–Lower Taylor Brook						
E3-P11-D01	12/01/93	3.78	0.08	35.00	NA	1.70
E3-P11-D02	12/01/93	3.98	0.10	1.00	NA	2.70
E3-P11-D03	09/15/93	6.80	0.05	10.00	4.90	23.00
E3-P11-D04	12/02/93	NA	NA	NA	NA	NA
E3-P13-D01	08/02/93	6.84	0.12	39.00	9.19	24.40
E3-P13-D01	12/01/93	6.08	0.10	5.00	NA	7.60
E3-P13-D03	12/01/93	3.78	0.10	4.00	NA	3.90
E3-P13-D04	12/01/93	5.52	0.07	1.00	NA	3.30
E3-P13-D05	12/01/93	5.48	0.08	1.00	NA	2.80
Watershed 2–Hop Brook						
E3-P37-D01	09/16/93	5.60	0.08	>999	1.70	14.00
E3-P37-D02	09/16/93	6.10	0.03	218.00	6.10	18.00
E3-P37-D03	09/16/93	6.50	0.04	180.00	5.70	15.00

Key:

NA = Not available.
μS/cm = Microsiemens per centimeter.
NTUs = Nepholometric turbidity units.

Source: Ecology and Environment, Inc. 1994.

TABLE N-2

WATER QUALITY PARAMETERS FOR GROUNDWATER

Sample Locations	Date	pH	Conductivity (µS/cm)	Turbidity (NTUs)	Dissolved Oxygen (µg/L)	Temp. (C°)
Watershed 1B–Lower Taylor Brook						
E3-P11-M01	08/24/93	9.30	0.108	13.00	0.05	11.80
E3-P11-M01	11/30/93	6.30	0.07	990.00	NA	9.00
OHM-P11-32	08/25/93	5.97	0.064	970.00	8.86	13.60
OHM-P11-32	11/30/93	6.60	0.03	0.00	NA	10.00
OHM-P11-33	08/25/93	NA	NA	NA	NA	NA
OHM-P11-33	11/30/93	NA	NA	NA	NA	NA
ATEC-1	09/02/93	0.044	461.00	461.00	5.29	17.10
ATEC-1	11/30/93	0.06	550.00	550.00	1.70	12.00
ATEC-2	09/02/93	0.076	870.00	870.00	7.96	19.10
ATEC-2	11/30/93	0.06	550.00	550.00	1.70	12.00
EHA3	11/30/93	0.132	3.00	3.00	0.20	10.70
E3-P13-M01	08/25/93	0.191	943.00	943.00	13.17	12.30
E3-P13-M01	11/29/93	0.22	0.8	0.8	NA	14.00
E3-P13-M02	08/24/93	0.495	151.00	151.00	3.52	14.70
E3-P13-M02	11/30/93	0.08	8.00	8.00	NA	12.00
E3-P13-M03	08/25/93	NA	NA	NA	NA	N1
E3-P13-M03	11/30/93	0.27	30.00	30.00	NA	8.00
E3-P13-M04	08/24/93	0.036	340.00	340.00	7.25	15.70
E3-P13-M04	11/29/93	0.03	30.00	30.00	NA	11.00
Watershed 2–Hop Brook						
E3-P36-M01	08/09/93	6.03	·0.085	>999	NR	17.30
E3-P36-M01	09/01/93	5.78	0.098	<10.00	4.90	15.20
E3-P36-M01	12/01/93	6.60	0.07	240.00	NA	12.00
E3-P36-M02	09/02/93	6.08	0.051	<10.00	7.69	14.10
E3-P36-M02	12/01/93	6.70	0.03	30.00	NA	13.00
E3-P36-M03	09/02/93	5.96	0.061	<10.00	6.58	14.10
E3-P36-M03	12/01/93	6.60	0.04	10.00	NA	13.00
E3-P36-M01	09/02/93	5.71	0.077	<10.00	7.45	15.70
E3-P36-M01	12/01/93	6.40	0.06	340.00	NA	6.40
E3-P36-M02	09/02/93	5.71	0.080	<10.00	6.63	15.30
E3-P36-M02	12/01/93	6.40	0.04	10.00	NA	12.00
E3-P36-M03	09/02/93	5.60	0.048	<10.00	9.11	12.20
E3-P36-M03	12/01/93	NA	NA	NA	NA	NA

Key:
NA = Not available.
NR = Not recorded.
µS/cm = Microsiemens per centimeter.
NTUs = Nepholometric turbidity units.
Source: Ecology and Environment, Inc. 1994.

O

APPENDIX O

DETAILED RISK ESTIMATION TABLES

Table O.1-1

DIRECTORY OF THE POTENTIAL EXPOSURE SCENARIOS INCLUDED IN THE QUANTITATIVE RISK ASSESSMENT SITE P11/P13

Receptor	Age Group	Exposure Case	Exposure Route	Exposure Area	Exposure and Risk Estimates Table
Site Trespasser	Adolescent	RME	1A Soil ingestion 1B Dermal contact	Site P11/P13	O.1-2
		Average	1A Soil ingestion 1B Dermal contact	Site P11/P13	O.1-3
		RME	1C Sediment ingestion 1D Dermal contact	Adjacent streams and wetland	O.1-4
		Average	1C Sediment ingestion 1D Dermal contact	Adjacent streams and wetland	O.1-5
Future Site Resident	Adult	RME	2A Soil ingestion 2B Dermal contact	Site P11/P13	O.1-6
		Average	2A Soil ingestion 2B Dermal contact	Site P11/P13	O.1-7
	Child	RME	2A Soil ingestion 2B Dermal contact	Site P11/P13	O.1-8
		Average	2A Soil ingestion 2B Dermal contact	Site P11/P13	O.1-9
	Adolescent	RME	2C Sediment ingestion 2D Dermal contact	Adjacent streams and wetland	O.1-10
		Average	2C Sediment ingestion 2D Dermal contact	Adjacent streams and wetland	O.1-11
	Adult	RME	2E Groundwater ingestion	Site P11/P13 (unfiltered)	O.1-12
		Average	2E Groundwater ingestion	Site P11/P13 (unfiltered)	O.1-13
	Child	RME	2E Groundwater ingestion	Site P11/P13 (unfiltered)	O.1-14
		Average	2E Groundwater ingestion	Site P11/P13 (unfiltered)	O.1-15
	Adult	RME	2E Groundwater ingestion	Site P11/P13 (filtered)	O.1-16
		Average	2E Groundwater ingestion	Site P11/P13 (filtered)	O.1-17
	Child	RME	2E Groundwater ingestion	Site P11/P13 (filtered)	O.1-18
		Average	2E Groundwater ingestion	Site P11/P13 (filtered)	O.1-19

Key:

RME = Reasonable Maximum Exposure.

Table 0.1-2

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
SITE TRESPASSER EXPOSURE TO SOIL
Location: Site P11/P13
Receptor: Adolescent
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects		Non-Carcinogenic Effects	
		Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index
Exposure Route: Ingestion of Chemicals in Soil					
Acenaphthene	7.47E-01	--	--	2.27E-08	3.78E-07
PCB 1254	3.40E-00	5.32E-09	4.10E-08	3.11E-08	1.56E-03
PCB 1260	4.55E-01	7.12E-10	5.48E-09	--	--
Barium	2.52E+02	--	--	7.67E-06	1.10E-04
Bis(2-ethylhexyl)phthalate	1.83E+01	9.55E-08	1.34E-09	5.57E-07	2.79E-05
2-Butanone	2.60E-03	--	--	7.91E-11	1.32E-10
Cadmium (soil)	1.42E+01	--	--	4.32E-07	4.32E-04
Chlordane	8.10E-01	1.27E-09	1.65E-09	7.40E-09	1.23E-04
Chromium(III)	3.84E+01	--	--	1.17E-06	1.17E-06
Chromium(VI)	4.30E-00	--	--	1.31E-07	2.62E-05
Chrysene	2.42E-00	1.26E-08	9.20E-11	7.37E-08	1.84E-06
Copper	5.50E+02	--	--	1.67E-05	4.51E-04
P,P'-DDD	5.90E-01	9.24E-10	2.22E-10	--	--
P,P'-DDE	8.40E-01	1.32E-09	4.49E-10	--	--
P,P'-DDT	1.10E-00	1.72E-09	5.85E-10	1.00E-08	2.00E-05
Dichloromethane	1.40E-02	7.31E-11	5.48E-13	4.26E-10	7.10E-09
Dieldrin	4.13E-02	2.16E-10	3.46E-09	1.26E-09	2.52E-05
Di-n-octyl Phthalate	1.49E-00	--	--	4.54E-08	2.27E-06
Endosulfan II(beta)	2.90E-01	--	--	8.83E-09	1.47E-06
Heptachlor	2.02E-02	3.16E-11	1.42E-10	1.84E-10	3.68E-07
Heptachlor Epoxide	1.60E-01	2.50E-10	2.28E-09	1.46E-09	1.12E-04
Lead	1.80E+02	--	--	--	--
Manganese (soil)	4.60E+02	--	--	1.40E-05	1.00E-04
Mercury (inorganic)	4.26E-01	--	--	1.30E-08	4.33E-05
2-Methylnaphthalene	2.61E-00	--	--	7.95E-08	1.99E-06
Nickel (Soluble Salts)	3.09E+01	--	--	9.41E-07	4.71E-05
Phenanthrene	2.11E-00	--	--	6.42E-08	1.61E-06
Pyrene	3.54E-00	--	--	1.08E-07	3.60E-06
Toluene	3.90E-03	--	--	1.19E-10	5.95E-10
1,1,1-Trichloroethane	1.60E-03	--	--	4.87E-11	5.41E-10
Trichlorofluoromethane	1.20E-02	--	--	3.65E-10	1.22E-09
Vanadium	1.09E+02	--	--	3.32E-06	4.74E-04
Zinc	9.10E+02	--	--	2.77E-05	9.23E-05
Ingestion Route Subtotal:			5.67E-08		3.64E-03

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Table 0.1-2 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects		Non-Carcinogenic Effects	
		Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index
Exposure Route: Dermal Contact with Contaminated Soil					
PCB 1254	3.40E-00	4.36E-08	3.36E-07	2.55E-07	1.28E-02
PCB 1260	4.55E-01	5.84E-09	4.50E-08	--	--
Cadmium (soil)	1.42E+01	--	--	1.77E-07	1.77E-04
Dermal Route Subtotal:			3.81E-07		1.30E-02
Receptor Total:			4.38E-07		1.66E-02

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Table 0.1-3

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
SITE TRESPASSER EXPOSURE TO SOIL
Location: Site P11/P13
Receptor: Adolescent
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Chemicals in Soil					
Acenaphthene	2.10E-01	--	--	6.39E-09	1.07E-07
PCB 1254	2.97E-01	4.65E-10	3.58E-09	2.71E-09	1.36E-04
PCB 1260	9.20E-02	1.44E-10	1.11E-09	--	--
Barium	4.11E+01	--	--	1.25E-06	1.79E-05
Bis(2-ethylhexyl)phthalate	1.94E-00	1.01E-08	1.41E-10	5.91E-08	2.96E-06
2-Butanone	2.00E-03	--	--	6.09E-11	1.02E-10
Cadmium (soil)	2.45E-00	--	--	7.46E-08	7.46E-05
Chlordane	1.15E-01	1.80E-10	2.34E-10	1.05E-09	1.75E-05
Chromium(III)	1.55E+01	--	--	4.72E-07	4.72E-07
Chromium(VI)	1.70E-00	--	--	5.18E-08	1.04E-05
Chrysene	3.61E-01	1.88E-09	1.37E-11	1.10E-08	2.75E-07
Copper	5.58E+01	--	--	1.70E-06	4.59E-05
P,P'-DDD	6.30E-02	9.86E-11	2.37E-11	--	--
P,P'-DDE	1.43E-01	2.24E-10	7.62E-11	--	--
P,P'-DDT	2.83E-01	4.43E-10	1.51E-10	2.58E-09	5.16E-06
Dichloromethane	3.60E-03	1.88E-11	1.41E-13	1.10E-10	1.83E-09
Dieldrin	8.70E-03	4.54E-11	7.26E-10	2.65E-10	5.30E-06
Di-n-octyl Phthalate	2.84E-01	--	--	8.65E-09	4.33E-07
Endosulfan II(beta)	2.30E-02	--	--	7.00E-10	1.17E-07
Heptachlor	5.90E-03	9.24E-12	4.16E-11	5.39E-11	1.08E-07
Heptachlor Epoxide	2.13E-02	3.33E-11	3.03E-10	1.95E-10	1.50E-05
Lead	7.24E+01	--	--	--	--
Manganese (soil)	1.96E+02	--	--	5.97E-06	4.26E-05
Mercury (inorganic)	8.00E-02	--	--	2.44E-09	8.13E-06
2-Methylnaphthalene	3.71E-01	--	--	1.13E-08	2.83E-07
Nickel (Soluble Salts)	1.29E+01	--	--	3.93E-07	1.97E-05
Phenanthrene	2.99E-01	--	--	9.10E-09	2.28E-07
Pyrene	8.17E-01	--	--	2.49E-08	8.30E-07
Toluene	1.10E-03	--	--	3.35E-11	1.68E-10
1,1,1-Trichloroethane	7.00E-04	--	--	2.13E-11	2.37E-10
Trichlorofluoromethane	1.20E-02	--	--	3.65E-10	1.22E-09
Vanadium	2.42E+01	--	--	7.37E-07	1.05E-04
Zinc	1.32E+02	--	--	4.02E-06	1.34E-05
Ingestion Route Subtotal:			6.39E-09		5.21E-04

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Table 0.1-3 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Dermal Contact with Contaminated Soil					
PCB 1254	2.97E-01	3.81E-09	2.93E-08	2.22E-08	1.11E-03
PCB 1260	9.20E-02	1.18E-09	9.09E-09	--	--
Cadmium (soil)	2.45E-00	--	--	3.06E-08	3.06E-05
Dermal Route Subtotal:			3.84E-08		1.14E-03
Receptor Total:			4.48E-08		1.66E-03

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Table 0.1-4

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
SITE TRESPASSER EXPOSURE TO SEDIMENT
Location: Site P11/P13
Receptor: Adolescent
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Chemicals in Sediment					
Antimony	1.01E-00	--	--	1.54E-08	3.85E-05
Arsenic	3.70E+01	9.65E-08	1.74E-07	5.63E-07	1.88E-03
Barium	5.92E+01	--	--	9.01E-07	1.29E-05
Benzo(b)fluoranthene	8.20E-02	2.14E-10	1.56E-10	1.25E-09	3.13E-08
Beryllium	6.32E-01	1.65E-09	7.10E-09	9.62E-09	1.92E-06
Cadmium (soil)	1.43E-00	--	--	2.18E-08	2.18E-05
Chromium(III)	1.37E+01	--	--	2.09E-07	2.09E-07
Chromium(VI)	1.50E-00	--	--	2.28E-08	4.56E-06
Copper	2.96E+01	--	--	4.51E-07	1.22E-05
P,P'-DDD	7.25E-01	5.68E-10	1.36E-10	--	--
P,P'-DDE	5.10E-01	3.99E-10	1.36E-10	--	--
P,P'-DDT	2.30E-01	1.80E-10	6.12E-11	1.05E-09	2.10E-06
Fluoranthene	1.20E-01	--	--	1.83E-09	4.58E-08
Lead	7.10E+01	--	--	--	--
Manganese (soil)	8.43E+01	--	--	1.28E-06	9.14E-06
Nickel (Soluble Salts)	2.65E+01	--	--	4.03E-07	2.02E-05
Pyrene	6.80E-02	--	--	1.04E-09	3.47E-08
Selenium	2.30E-00	--	--	3.50E-08	7.00E-06
Vanadium	2.69E+01	--	--	4.09E-07	5.84E-05
Zinc	3.70E+02	--	--	5.63E-06	1.88E-05
Ingestion Route Subtotal:			1.81E-07		2.08E-03

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Table 0.1-4 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Dermal Contact with Contaminated Sediment					
Cadmium (soil)	1.43E-00	--	--	8.92E-09	8.92E-06
Dermal Route Subtotal:			0.00E+00		8.92E-06
Receptor Total:			1.81E-07		2.09E-03

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Table 0.1-5

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
SITE TRESPASSER EXPOSURE TO SEDIMENT
Location: Site P11/P13
Receptor: Adolescent
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Chemicals in Sediment					
Antimony	3.45E-01	--	--	5.25E-09	1.31E-05
Arsenic	8.02E-00	2.09E-08	3.76E-08	1.22E-07	4.07E-04
Barium	2.27E+01	--	--	3.46E-07	4.94E-06
Benzo(b)fluoranthene	8.20E-02	2.14E-10	1.56E-10	1.25E-09	3.13E-08
Beryllium	2.65E-01	6.91E-10	2.97E-09	4.03E-09	8.06E-07
Cadmium (soil)	4.18E-01	--	--	6.36E-09	6.36E-06
Chromium(III)	6.82E-00	--	--	1.04E-07	1.04E-07
Chromium(VI)	7.60E-01	--	--	1.16E-08	2.32E-06
Copper	1.07E+01	--	--	1.63E-07	4.41E-06
P,P'-DDD	1.34E-01	1.05E-10	2.52E-11	--	--
P,P'-DDE	1.03E-01	8.06E-11	2.74E-11	--	--
P,P'-DDT	5.60E-02	4.38E-11	1.49E-11	2.56E-10	5.12E-07
Fluoranthene	1.20E-01	--	--	1.83E-09	4.58E-08
Lead	2.85E+01	--	--	--	--
Manganese (soil)	4.81E+01	--	--	7.32E-07	5.23E-06
Nickel (Soluble Salts)	9.44E-00	--	--	1.44E-07	7.20E-06
Pyrene	6.80E-02	--	--	1.04E-09	3.47E-08
Selenium	1.90E-00	--	--	2.89E-08	5.78E-06
Vanadium	1.14E+01	--	--	1.74E-07	2.49E-05
Zinc	9.46E+01	--	--	1.44E-06	4.80E-06
Ingestion Route Subtotal:			4.08E-08		4.87E-04

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Table 0.1-5 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects Intake (mg/kg/day)	Carcinogenic Effects Cancer Risk	Non-Carcinogenic Effects Intake (mg/kg/day)	Non-Carcinogenic Effects Hazard Index
Exposure Route: Dermal Contact with Contaminated Sediment					
Cadmium (soil)	4.18E-01	--	--	2.61E-09	2.61E-06
Dermal Route Subtotal:			0.00E+00		2.61E-06
Receptor Total:			4.08E-08		4.90E-04

Table O.1-6

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE TO SOIL
Location: Site P11/P13
Receptor: Adult
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Chemicals in Soil					
Acenaphthene	7.47E-01	--	--	1.02E-06	1.70E-05
PCB 1254	3.40E-00	5.99E-07	4.61E-06	1.40E-06	7.00E-02
PCB 1260	4.55E-01	8.01E-08	6.17E-07	--	--
Barium	2.52E+02	--	--	3.45E-04	4.93E-03
Bis(2-ethylhexyl)phthalate	1.83E+01	1.07E-05	1.50E-07	2.51E-05	1.26E-03
2-Butanone	2.60E-03	--	--	3.56E-09	5.93E-09
Cadmium (soil)	1.42E+01	--	--	1.95E-05	1.95E-02
Chlordane	8.10E-01	1.43E-07	1.86E-07	3.33E-07	5.55E-03
Chromium(III)	3.84E+01	--	--	5.26E-05	5.26E-05
Chromium(VI)	4.30E-00	--	--	5.89E-06	1.18E-03
Chrysene	2.42E-00	1.42E-06	1.04E-08	3.32E-06	8.30E-05
Copper	5.50E+02	--	--	7.53E-04	2.04E-02
P,P'-DDD	5.90E-01	1.04E-07	2.50E-08	--	--
P,P'-DDE	8.40E-01	1.48E-07	5.03E-08	--	--
P,P'-DDT	1.10E-00	1.94E-07	6.60E-08	4.52E-07	9.04E-04
Dichloromethane	1.40E-02	8.22E-09	6.17E-11	1.92E-08	3.20E-07
Dieldrin	4.13E-02	2.42E-08	3.87E-07	5.66E-08	1.13E-03
Di-n-octyl Phthalate	1.49E-00	--	--	2.04E-06	1.02E-04
Endosulfan II(beta)	2.90E-01	--	--	3.97E-07	6.62E-05
Heptachlor	2.02E-02	3.56E-09	1.60E-08	8.30E-09	1.66E-05
Heptachlor Epoxide	1.60E-01	2.82E-08	2.57E-07	6.58E-08	5.06E-03
Lead	1.80E+02	--	--	--	--
Manganese (soil)	4.60E+02	--	--	6.30E-04	4.50E-03
Mercury (inorganic)	4.26E-01	--	--	5.84E-07	1.95E-03
2-Methylnaphthalene	2.61E-00	--	--	3.58E-06	8.95E-05
Nickel (Soluble Salts)	3.09E+01	--	--	4.23E-05	2.12E-03
Phenanthrene	2.11E-00	--	--	2.89E-06	7.23E-05
Pyrene	3.54E-00	--	--	4.85E-06	1.62E-04
Toluene	3.90E-03	--	--	5.34E-09	2.67E-08
1,1,1-Trichloroethane	1.60E-03	--	--	2.19E-09	2.43E-08
Trichlorofluoromethane	1.20E-02	--	--	1.64E-08	5.47E-08
Vanadium	1.09E+02	--	--	1.49E-04	2.13E-02
Zinc	9.10E+02	--	--	1.25E-03	4.17E-03
Ingestion Route Subtotal:			6.40E-06		1.63E-01

Table O.1-6 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Dermal Contact with Contaminated Soil					
PCB 1254	3.40E-00	6.83E-06	5.26E-05	1.59E-05	7.95E-01
PCB 1260	4.55E-01	9.14E-07	7.04E-06	--	--
Cadmium (soil)	1.42E+01	--	--	1.11E-05	1.11E-02
Dermal Route Subtotal:			5.96E-05		8.06E-01
Receptor Total:			6.60E-05		9.69E-01

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Table 0.1-7

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE TO SOIL
Location: Site P11/P13
Receptor: Adult
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects		Non-Carcinogenic Effects	
		Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index
Exposure Route: Ingestion of Chemicals in Soil					
Acenaphthene	1.85E-01	--	--	2.53E-07	4.22E-06
PCB 1254	2.09E-01	3.68E-08	2.83E-07	8.59E-08	4.30E-03
PCB 1260	6.90E-02	1.22E-08	9.39E-08	--	--
Barium	3.26E+01	--	--	4.47E-05	6.39E-04
Bis(2-ethylhexyl)phthalate	1.57E-00	9.22E-07	1.29E-08	2.15E-06	1.08E-04
2-Butanone	2.00E-03	--	--	2.74E-09	4.57E-09
Cadmium (soil)	2.73E-00	--	--	3.74E-06	3.74E-03
Chlordane	8.20E-02	1.44E-08	1.87E-08	3.37E-08	5.62E-04
Chromium(III)	1.38E+01	--	--	1.89E-05	1.89E-05
Chromium(VI)	1.50E-00	--	--	2.05E-06	4.10E-04
Chrysene	2.64E-01	1.55E-07	1.13E-09	3.62E-07	9.05E-06
Copper	4.06E+01	--	--	5.56E-05	1.50E-03
P,P'-DDD	4.50E-02	7.93E-09	1.90E-09	--	--
P,P'-DDE	1.00E-01	1.76E-08	5.98E-09	--	--
P,P'-DDT	1.94E-01	3.42E-08	1.16E-08	7.97E-08	1.59E-04
Dichloromethane	3.30E-03	1.94E-09	1.46E-11	4.52E-09	7.53E-08
Dieldrin	7.20E-03	4.23E-09	6.77E-08	9.86E-09	1.97E-04
Di-n-octyl Phthalate	2.29E-01	--	--	3.14E-07	1.57E-05
Endosulfan II(beta)	1.70E-02	--	--	2.33E-08	3.88E-06
Heptachlor	5.50E-03	9.69E-10	4.36E-09	2.26E-09	4.52E-06
Heptachlor Epoxide	1.52E-02	2.68E-09	2.44E-08	6.25E-09	4.81E-04
Lead	5.05E+01	--	--	--	--
Manganese (soil)	1.62E+02	--	--	2.22E-04	1.59E-03
Mercury (inorganic)	6.70E-02	--	--	9.18E-08	3.06E-04
2-Methylnaphthalene	2.69E-01	--	--	3.68E-07	9.20E-06
Nickel (Soluble Salts)	1.08E+01	--	--	1.48E-05	7.40E-04
Phenanthrene	2.17E-01	--	--	2.97E-07	7.43E-06
Pyrene	6.00E-01	--	--	8.22E-07	2.74E-05
Toluene	1.00E-03	--	--	1.37E-09	6.85E-09
1,1,1-Trichloroethane	7.00E-04	--	--	9.59E-10	1.07E-08
Trichlorofluoromethane	1.20E-02	--	--	1.64E-08	5.47E-08
Vanadium	2.03E+01	--	--	2.78E-05	3.97E-03
Zinc	9.53E+01	--	--	1.31E-04	4.37E-04
Ingestion Route Subtotal:			5.26E-07		1.92E-02

Table 0.1-7 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects		Non-Carcinogenic Effects	
		Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index
Exposure Route: Dermal Contact with Contaminated Soil					
PCB 1254	2.09E-01	4.20E-07	3.23E-06	9.79E-07	4.90E-02
PCB 1260	6.90E-02	1.39E-07	1.07E-06	--	--
Cadmium (soil)	2.73E-00	--	--	2.13E-06	2.13E-03
Dermal Route Subtotal:			4.30E-06		5.11E-02
Receptor Total:			4.83E-06		7.03E-02

Table 0.1-8

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE TO SOIL
Location: Site P11/P13
Receptor: Child
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index[a]
Exposure Route: Ingestion of Chemicals in Soil					
Acenaphthene	7.47E-01	--	--	9.55E-06	1.59E-05
PCB 1254	3.40E-00	1.12E-06	8.62E-06	1.30E-05	6.50E-01
PCB 1260	4.55E-01	1.50E-07	1.16E-06	--	--
Barium	2.52E+02	--	--	3.22E-03	4.60E-02
Bis(2-ethylhexyl)phthalate	1.83E+01	2.01E-05	2.81E-07	2.34E-04	1.17E-02
2-Butanone	2.60E-03	--	--	3.32E-08	1.66E-08
Cadmium (soil)	1.42E+01	--	--	1.82E-04	1.82E-01
Chlordane	8.10E-01	2.66E-07	3.46E-07	3.11E-06	5.18E-02
Chromium(III)	3.84E+01	--	--	4.91E-04	4.91E-04
Chromium(VI)	4.30E-00	--	--	5.50E-05	2.75E-03
Chrysene	2.42E-00	2.65E-06	1.93E-08	3.09E-05	7.73E-04
Copper	5.50E+02	--	--	7.03E-03	1.90E-01
P,P'-DDD	5.90E-01	1.94E-07	4.66E-08	--	--
P,P'-DDE	8.40E-01	2.76E-07	9.38E-08	--	--
P,P'-DDT	1.10E-00	3.62E-07	1.23E-07	4.22E-06	8.44E-03
Dichloromethane	1.40E-02	1.53E-08	1.15E-10	1.79E-07	2.98E-06
Dieldrin	4.13E-02	4.53E-08	7.25E-07	5.28E-07	1.06E-02
Di-n-octyl Phthalate	1.49E-00	--	--	1.91E-05	9.55E-04
Endosulfan II(beta)	2.90E-01	--	--	3.71E-06	6.18E-04
Heptachlor	2.02E-02	6.64E-09	2.99E-08	7.75E-08	1.55E-04
Heptachlor Epoxide	1.60E-01	5.26E-08	4.79E-07	6.14E-07	4.72E-02
Lead	1.80E+02	--	--	--	--
Manganese (soil)	4.60E+02	--	--	5.88E-03	4.20E-02
Mercury (inorganic)	4.26E-01	--	--	5.45E-06	1.82E-02
2-Methylnaphthalene	2.61E-00	--	--	3.34E-05	8.35E-04
Nickel (Soluble Salts)	3.09E+01	--	--	3.95E-04	1.98E-02
Phenanthrene	2.11E-00	--	--	2.70E-05	6.75E-04
Pyrene	3.54E-00	--	--	4.53E-05	1.51E-04
Toluene	3.90E-03	--	--	4.99E-08	2.50E-08
1,1,1-Trichloroethane	1.60E-03	--	--	2.05E-08	2.28E-08
Trichlorofluoromethane	1.20E-02	--	--	1.53E-07	2.19E-07
Vanadium	1.09E+02	--	--	1.39E-03	1.99E-01
Zinc	9.10E+02	--	--	1.16E-02	3.87E-02
Ingestion Route Subtotal:			1.18E-05		1.53E+00

Table 0.1-8 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects		Non-Carcinogenic Effects	
		Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index[a]
Exposure Route: Dermal Contact with Contaminated Soil					
PCB 1254	3.40E-00	3.58E-06	2.76E-05	4.17E-05	2.09E+00
PCB 1260	4.55E-01	4.79E-07	3.69E-06	--	--
Cadmium (soil)	1.42E+01	--	--	2.90E-05	2.90E-02
Dermal Route Subtotal:			3.13E-05		2.12E+00
Receptor Total:			4.31E-05		3.65E+00

[a]Calculated using subchronic RfD.

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Table 0.1-9

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE TO SOIL
Location: Site P11/P13
Receptor: Child
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects		Non-Carcinogenic Effects	
		Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index[a]
Exposure Route: Ingestion of Chemicals in Soil					
Acenaphthene	1.85E-01	--	--	2.37E-06	3.95E-06
PCB 1254	2.09E-01	6.87E-08	5.29E-07	8.02E-07	4.01E-02
PCB 1260	6.90E-02	2.27E-08	1.75E-07	--	--
Barium	3.26E+01	--	--	4.17E-04	5.96E-03
Bis(2-ethylhexyl)phthalate	1.57E-00	1.72E-06	2.41E-08	2.01E-05	1.01E-03
2-Butanone	2.00E-03	--	--	2.56E-08	1.28E-08
Cadmium (soil)	2.73E-00	--	--	3.49E-05	3.49E-02
Chlordane	8.20E-02	2.70E-08	3.51E-08	3.15E-07	5.25E-03
Chromium(III)	1.38E+01	--	--	1.76E-04	1.76E-04
Chromium(VI)	1.50E-00	--	--	1.92E-05	9.60E-04
Chrysene	2.64E-01	2.89E-07	2.11E-09	3.38E-06	8.45E-05
Copper	4.06E+01	--	--	5.19E-04	1.40E-02
P,P'-DDD	4.50E-02	1.48E-08	3.55E-09	--	--
P,P'-DDE	1.00E-01	3.29E-08	1.12E-08	--	--
P,P'-DDT	1.94E-01	6.38E-08	2.17E-08	7.44E-07	1.49E-03
Dichloromethane	3.30E-03	3.62E-09	2.72E-11	4.22E-08	7.03E-07
Dieldrin	7.20E-03	7.89E-09	1.26E-07	9.21E-08	1.84E-03
Di-n-octyl Phthalate	2.29E-01	--	--	2.93E-06	1.47E-04
Endosulfan II(beta)	1.70E-02	--	--	2.17E-07	3.62E-05
Heptachlor	5.50E-03	1.81E-09	8.15E-09	2.11E-08	4.22E-05
Heptachlor Epoxide	1.52E-02	5.00E-09	4.55E-08	5.83E-08	4.48E-03
Lead	5.05E+01	--	--	--	--
Manganese (soil)	1.62E+02	--	--	2.07E-03	1.48E-02
Mercury (inorganic)	6.70E-02	--	--	8.57E-07	2.86E-03
2-Methylnaphthalene	2.69E-01	--	--	3.44E-06	8.60E-05
Nickel (Soluble Salts)	1.08E+01	--	--	1.38E-04	6.90E-03
Phenanthrene	2.17E-01	--	--	2.77E-06	6.93E-05
Pyrene	6.00E-01	--	--	7.67E-06	2.56E-05
Toluene	1.00E-03	--	--	1.28E-08	6.40E-09
1,1,1-Trichloroethane	7.00E-04	--	--	8.95E-09	9.94E-09
Trichlorofluoromethane	1.20E-02	--	--	1.53E-07	2.19E-07
Vanadium	2.03E+01	--	--	2.60E-04	3.71E-02
Zinc	9.53E+01	--	--	1.22E-03	4.07E-03
Ingestion Route Subtotal:			9.82E-07		1.76E-01

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Table 0.1-9 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index[a]
Exposure Route: Dermal Contact with Contaminated Soil					
PCB 1254	2.09E-01	2.20E-07	1.69E-06	2.57E-06	1.29E-01
PCB 1260	6.90E-02	7.26E-08	5.59E-07	--	--
Cadmium (soil)	2.73E-00	--	--	5.59E-06	5.59E-03
Dermal Route Subtotal:			2.25E-06		1.35E-01
Receptor Total:			3.23E-06		3.11E-01

[a]Calculated using subchronic RfD.

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Table 0.1-10

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE TO SEDIMENT
Location: Site P11/P13
Receptor: Adolescent
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Chemicals in Sediment					
Antimony	1.01E-00	--	--	3.07E-07	7.68E-04
Arsenic	3.70E+01	1.93E-06	3.47E-06	1.13E-05	3.77E-02
Barium	5.92E+01	--	--	1.80E-05	2.57E-04
Benzo(b)fluoranthene	8.20E-02	4.28E-09	3.12E-09	2.50E-08	6.25E-07
Beryllium	6.32E-01	3.30E-08	1.42E-07	1.92E-07	3.84E-05
Cadmium (soil)	1.43E-00	--	--	4.35E-07	4.35E-04
Chromium(III)	1.37E+01	--	--	4.17E-06	4.17E-06
Chromium(VI)	1.50E-00	--	--	4.57E-07	9.14E-05
Copper	2.96E+01	--	--	9.01E-06	2.44E-04
P,P'-DDD	7.25E-01	1.14E-08	2.74E-09	--	--
P,P'-DDE	5.10E-01	7.98E-09	2.71E-09	--	--
P,P'-DDT	2.30E-01	3.60E-09	1.22E-09	2.10E-08	4.20E-05
Fluoranthene	1.20E-01	--	--	3.65E-08	9.13E-07
Lead	7.10E+01	--	--	--	--
Manganese (soil)	8.43E+01	--	--	2.57E-05	1.84E-04
Nickel (Soluble Salts)	2.65E+01	--	--	8.07E-06	4.04E-04
Pyrene	6.80E-02	--	--	2.07E-08	6.90E-07
Selenium	2.30E-00	--	--	7.00E-07	1.40E-04
Vanadium	2.69E+01	--	--	8.19E-06	1.17E-03
Zinc	3.70E+02	--	--	1.13E-04	3.77E-04
Ingestion Route Subtotal:			3.61E-06		4.18E-02

Table O.1-10 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects		Non-Carcinogenic Effects	
		Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index
Exposure Route: Dermal Contact with Contaminated Sediment					
Cadmium (soil)	1.43E-00	--	--	1.78E-07	1.78E-04
Dermal Route Subtotal:			0.00E+00		1.78E-04
Receptor Total:			3.61E-06		4.20E-02

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Table O.1-11

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE TO SEDIMENT
Location: Site P11/P13
Receptor: Adolescent
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Chemicals in Sediment					
Antimony	3.45E-01	--	--	1.05E-07	2.63E-04
Arsenic	8.02E-00	4.19E-07	7.54E-07	2.44E-06	8.13E-03
Barium	2.27E+01	--	--	6.91E-06	9.87E-05
Benzo(b)fluoranthene	8.20E-02	4.28E-09	3.12E-09	2.50E-08	6.25E-07
Beryllium	2.65E-01	1.38E-08	5.93E-08	8.07E-08	1.61E-05
Cadmium (soil)	4.18E-01	--	--	1.27E-07	1.27E-04
Chromium(III)	6.82E-00	--	--	2.08E-06	2.08E-06
Chromium(VI)	7.60E-01	--	--	2.31E-07	4.62E-05
Copper	1.07E+01	--	--	3.26E-06	8.81E-05
P,P'-DDD	1.34E-01	2.10E-09	5.04E-10	--	--
P,P'-DDE	1.03E-01	1.61E-09	5.47E-10	--	--
P,P'-DDT	5.60E-02	8.77E-10	2.98E-10	5.11E-09	1.02E-05
Fluoranthene	1.20E-01	--	--	3.65E-08	9.13E-07
Lead	2.85E+01	--	--	--	--
Manganese (soil)	4.81E+01	--	--	1.46E-05	1.04E-04
Nickel (Soluble Salts)	9.44E-00	--	--	2.87E-06	1.44E-04
Pyrene	6.80E-02	--	--	2.07E-08	6.90E-07
Selenium	1.90E-00	--	--	5.78E-07	1.16E-04
Vanadium	1.14E+01	--	--	3.47E-06	4.96E-04
Zinc	9.46E+01	--	--	2.88E-05	9.60E-05
Ingestion Route Subtotal:			8.18E-07		9.75E-03

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Table 0.1-11 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects		Non-Carcinogenic Effects	
		Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index
Exposure Route: Dermal Contact with Contaminated Sediment					
Cadmium (soil)	4.18E-01	--	--	5.22E-08	5.22E-05
Dermal Route Subtotal:			0.00E+00		5.22E-05
Receptor Total:			8.18E-07		9.80E-03

Table 0.1-12

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Unfiltered
Location: Site P11/P13
Receptor: Adult
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/L)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Drinking Water					
Antimony	1.23E-02	--	--	3.37E-04	8.43E-01
Arsenic	3.75E-02	4.40E-04	7.92E-04	1.03E-03	3.43E+00
Barium	1.98E-01	--	--	5.42E-03	7.74E-02
Beryllium	1.61E-03	1.89E-05	8.13E-05	4.41E-05	8.82E-03
Chlordane	2.61E-04	3.06E-06	3.98E-06	7.15E-06	1.19E-01
Chromium(VI)	6.44E-02	--	--	1.76E-03	3.52E-01
Copper	4.54E-02	--	--	1.24E-03	3.35E-02
P,P'-DDT	7.00E-05	8.22E-07	2.79E-07	1.92E-06	3.84E-03
Endrin	4.30E-05	--	--	1.18E-06	3.93E-03
Heptachlor Epoxide	2.60E-05	3.05E-07	2.78E-06	7.12E-07	5.48E-02
Lead	8.02E-02	--	--	--	--
Nickel (Soluble Salts)	6.16E-02	--	--	1.69E-03	8.45E-02
Toluene	3.40E-02	--	--	9.32E-04	4.66E-03
Vanadium	6.98E-02	--	--	1.91E-03	2.73E-01
Zinc	4.16E-01	--	--	1.14E-02	3.80E-02
Manganese (drinking water)	5.88E-01	--	--	1.61E-02	3.22E+00
Ingestion Route Subtotal:			8.80E-04		8.52E+00
Receptor Total:			8.80E-04		8.52E+00

Table 0.1-13

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Unfiltered
Location: Site P11/P13
Receptor: Adult
Case: Average Exposure

		Carcinogenic Effects		Non-Carcinogenic Effects	
Chemical	Exposure Point Concentration (mg/L)	Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index
Exposure Route: Ingestion of Drinking Water					
Antimony	3.03E-03	--	--	8.30E-05	2.08E-01
Arsenic	6.79E-03	7.97E-05	1.43E-04	1.86E-04	6.20E-01
Barium	4.85E-02	--	--	1.33E-03	1.90E-02
Beryllium	7.84E-04	9.21E-06	3.96E-05	2.15E-05	4.30E-03
Chlordane	1.21E-04	1.42E-06	1.85E-06	3.32E-06	5.53E-02
Chromium(VI)	1.88E-02	--	--	5.15E-04	1.03E-01
Copper	1.32E-02	--	--	3.62E-04	9.78E-03
P,P'-DDT	2.10E-05	2.47E-07	8.40E-08	5.75E-07	1.15E-03
Endrin	2.70E-05	--	--	7.40E-07	2.47E-03
Heptachlor Epoxide	9.00E-06	1.06E-07	9.65E-07	2.47E-07	1.90E-02
Lead	1.10E-02	--	--	--	--
Nickel (Soluble Salts)	1.52E-02	--	--	4.16E-04	2.08E-02
Toluene	2.98E-03	--	--	8.16E-05	4.08E-04
Vanadium	1.84E-02	--	--	5.04E-04	7.20E-02
Zinc	2.04E-01	--	--	5.59E-03	1.86E-02
Manganese (drinking water)	1.52E-01	--	--	4.16E-03	8.32E-01
Ingestion Route Subtotal:			1.86E-04		1.98E+00
Receptor Total:			1.86E-04		1.98E+00

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Table 0.1-14

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Unfiltered
Location: Site P11/P13
Receptor: Child
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/L)	Carcinogenic Effects		Non-Carcinogenic Effects	
		Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index[a]
Exposure Route: Ingestion of Drinking Water					
Antimony	1.23E-02	--	--	7.86E-04	1.97E+00
Arsenic	3.75E-02	2.05E-04	3.69E-04	2.40E-03	8.00E+00
Barium	1.98E-01	--	--	1.27E-02	1.81E-01
Beryllium	1.61E-03	8.82E-06	3.79E-05	1.03E-04	2.06E-02
Chlordane	2.61E-04	1.43E-06	1.86E-06	1.67E-05	2.78E-01
Chromium(VI)	6.44E-02	--	--	4.12E-03	2.06E-01
Copper	4.54E-02	--	--	2.90E-03	7.84E-02
P,P'-DDT	7.00E-05	3.84E-07	1.31E-07	4.47E-06	8.94E-03
Endrin	4.30E-05	--	--	2.75E-06	9.17E-03
Heptachlor Epoxide	2.60E-05	1.42E-07	1.29E-06	1.66E-06	1.28E-01
Lead	8.02E-02	--	--	--	--
Nickel (Soluble Salts)	6.16E-02	--	--	3.94E-03	1.97E-01
Toluene	3.40E-02	--	--	2.17E-03	1.09E-03
Vanadium	6.98E-02	--	--	4.46E-03	6.37E-01
Zinc	4.16E-01	--	--	2.66E-02	8.87E-02
Manganese (drinking water)	5.88E-01	--	--	3.76E-02	7.52E+00
Ingestion Route Subtotal:			4.10E-04		1.93E+01
Receptor Total:			4.10E-04		1.93E+01

[a]Calculated using subchronic RfD.

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Table 0.1-15

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Unfiltered
Location: Site P11/P13
Receptor: Child
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/L)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index[a]
Exposure Route: Ingestion of Drinking Water					
Antimony	3.03E-03	--	--	1.94E-04	4.85E-01
Arsenic	6.79E-03	3.72E-05	6.70E-05	4.34E-04	1.45E+00
Barium	4.85E-02	--	--	3.10E-03	4.43E-02
Beryllium	7.84E-04	4.30E-06	1.85E-05	5.01E-05	1.00E-02
Chlordane	1.21E-04	6.63E-07	8.62E-07	7.74E-06	1.29E-01
Chromium(VI)	1.88E-02	--	--	1.20E-03	6.00E-02
Copper	1.32E-02	--	--	8.44E-04	2.28E-02
P,P'-DDT	2.10E-05	1.15E-07	3.91E-08	1.34E-06	2.68E-03
Endrin	2.70E-05	--	--	1.73E-07	5.77E-03
Heptachlor Epoxide	9.00E-06	4.93E-08	4.49E-07	5.75E-07	4.42E-02
Lead	1.10E-02	--	--	--	--
Nickel (Soluble Salts)	1.52E-02	--	--	9.72E-04	4.86E-02
Toluene	2.98E-03	--	--	1.91E-04	9.55E-05
Vanadium	1.84E-02	--	--	1.18E-03	1.69E-02
Zinc	2.04E-01	--	--	1.30E-02	4.33E-02
Manganese (drinking water)	1.52E-01	--	--	9.72E-03	1.94E+00
Ingestion Route Subtotal:			8.68E-05		4.45E+00
Receptor Total:			8.68E-05		4.45E+00

[a]Calculated using subchronic RfD.

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Table 0.1-16

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Filtered[a]
Location: Site P11/P13
Receptor: Adult
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/L)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Drinking Water					
Antimony	2.50E-03	--	--	6.85E-05	1.71E-01
Arsenic	8.21E-03	9.64E-05	1.74E-04	2.25E-04	7.50E-01
Barium	3.56E-02	--	--	9.75E-04	1.39E-02
Beryllium	2.50E-03	2.94E-05	1.26E-04	6.85E-05	1.37E-02
Chlordane	2.61E-04	3.06E-06	3.98E-06	7.15E-06	1.19E-01
Chromium(VI)	2.35E-02	--	--	6.44E-04	1.29E-01
Copper	2.10E-02	--	--	5.75E-04	1.55E-02
P,P'-DDT	7.00E-05	8.22E-07	2.79E-07	1.92E-06	3.84E-03
Endrin	4.30E-05	--	--	1.18E-06	3.93E-03
Heptachlor Epoxide	2.60E-05	3.05E-07	2.78E-06	7.12E-07	5.48E-02
Lead	3.74E-03	--	--	--	--
Nickel (Soluble Salts)	1.50E-02	--	--	4.11E-04	2.06E-02
Toluene	3.40E-02	--	--	9.32E-04	4.66E-03
Vanadium	4.24E-02	--	--	1.16E-03	1.66E-01
Zinc	2.29E-02	--	--	6.27E-04	2.09E-03
Manganese (drinking water)	2.71E-01	--	--	7.42E-03	1.48E+00
Ingestion Route Subtotal:			3.07E-04		2.94E+00
Receptor Total:			3.07E-04		2.94E+00

[a]All groundwater COPCs included. Inorganic COPCs not detected in filtered groundwater were assumed to be present at 1/2 their respective quantitation limits.

Table 0.1-17

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Filtered[a]
Location: Site P11/P13
Receptor: Adult
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/L)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Drinking Water					
Antimony	2.50E-03	--	--	6.85E-05	1.71E-01
Arsenic	1.64E-03	1.93E-05	3.47E-05	4.49E-05	1.50E-01
Barium	1.13E-02	--	--	3.10E-04	4.43E-03
Beryllium	2.11E-03	2.48E-05	1.07E-04	5.78E-05	1.16E-02
Chlordane	1.21E-04	1.42E-06	1.85E-06	3.32E-06	5.53E-02
Chromium(VI)	4.98E-03	--	--	1.36E-04	2.72E-02
Copper	4.19E-03	--	--	1.15E-04	3.11E-03
P,P'-DDT	2.10E-05	2.47E-07	8.40E-08	5.75E-07	1.15E-03
Endrin	2.70E-05	--	--	7.40E-07	2.47E-03
Heptachlor Epoxide	9.00E-06	1.06E-07	9.65E-07	2.47E-07	1.90E-02
Lead	2.38E-03	--	--	--	--
Nickel (Soluble Salts)	7.68E-03	--	--	2.10E-04	1.05E-02
Toluene	2.98E-03	--	--	8.16E-05	4.08E-04
Vanadium	8.09E-03	--	--	2.22E-04	3.17E-02
Zinc	1.55E-02	--	--	4.25E-04	1.42E-03
Manganese (drinking water)	4.82E-02	--	--	1.32E-03	2.64E-01
Ingestion Route Subtotal:			1.45E-04		7.52E-01
Receptor Total:			1.45E-04		7.52E-01

[a]All groundwater COPCs included. Inorganic COPCs not detected in filtered groundwater were assumed to be present at 1/2 their respective quantitation limits.

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Table O.1-18

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Filtered[a]
Location: Site P11/P13
Receptor: Child
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/L)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index[b]
Exposure Route: Ingestion of Drinking Water					
Antimony	2.50E-03	--	--	1.60E-04	4.00E-01
Arsenic	8.21E-03	4.50E-05	8.10E-05	5.25E-04	1.75E+00
Barium	3.56E-02	--	--	2.28E-03	3.26E-02
Beryllium	2.50E-03	1.37E-05	5.89E-05	1.60E-04	3.20E-02
Chlordane	2.61E-04	1.43E-06	1.86E-06	1.67E-05	2.78E-01
Chromium(VI)	2.35E-02	--	--	1.50E-03	7.50E-02
Copper	2.10E-02	--	--	1.34E-03	3.62E-02
P,P'-DDT	7.00E-05	3.84E-07	1.31E-07	4.47E-06	8.94E-03
Endrin	4.30E-05	--	--	2.75E-06	9.17E-03
Heptachlor Epoxide	2.60E-05	1.42E-07	1.29E-06	1.66E-06	1.28E-01
Lead	3.74E-03	--	--	--	--
Nickel (Soluble Salts)	1.50E-02	--	--	9.59E-04	4.80E-02
Toluene	3.40E-02	--	--	2.17E-03	1.09E-03
Vanadium	4.24E-02	--	--	2.71E-03	3.87E-01
Zinc	2.29E-02	--	--	1.46E-03	4.87E-03
Manganese (drinking water)	2.71E-01	--	--	1.73E-02	3.46E+00
Ingestion Route Subtotal:			1.43E-04		6.66E+00
Receptor Total:			1.43E-04		6.66E+00

[a]All groundwater COPCs included. Inorganic COPCs not detected in filtered groundwater were assumed to be present at 1/2 their respective quantitation limits.

[b]Calculated using subchronic RfD.

Table O.1-19

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Filtered[a]
Location: Site P11/P13
Receptor: Child
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/L)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index[a]
Exposure Route: Ingestion of Drinking Water					
Antimony	2.50E-03	--	--	1.60E-05	4.00E-01
Arsenic	1.64E-03	8.99E-06	1.62E-05	1.05E-04	3.50E-01
Barium	1.13E-02	--	--	7.22E-04	1.03E-02
Beryllium	2.11E-03	1.16E-05	4.99E-05	1.35E-04	2.70E-02
Chlordane	1.21E-04	6.63E-07	8.62E-07	7.74E-06	1.29E-01
Chromium(VI)	4.98E-03	--	--	3.18E-04	1.59E-02
Copper	4.19E-03	--	--	2.68E-04	7.24E-03
P,P'-DDT	2.10E-05	1.15E-07	3.91E-08	1.34E-06	2.68E-03
Endrin	2.70E-05	--	--	1.73E-06	5.77E-03
Heptachlor Epoxide	9.00E-06	4.93E-08	4.49E-07	5.75E-07	4.42E-02
Lead	2.38E-03	--	--	--	--
Nickel (Soluble Salts)	7.68E-03	--	--	4.90E-04	2.46E-02
Toluene	2.98E-03	--	--	1.91E-04	9.55E-05
Vanadium	8.09E-03	--	--	5.17E-04	7.39E-02
Zinc	1.55E-02	--	--	9.91E-04	3.30E-03
Manganese (drinking water)	4.82E-02	--	--	3.08E-03	6.16E-01
Ingestion Route Subtotal:			6.74E-05		1.71E+00
Receptor Total:			6.74E-05		1.71E+00

[a]All groundwater COPCs included. Inorganic COPCs not detected in filtered groundwater were assumed to be present at 1/2 their respective quantitation limits.

[b]Calculated using subchronic RfD.

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Table O.2-1

DIRECTORY OF THE POTENTIAL EXPOSURE SCENARIOS INCLUDED IN THE QUANTITATIVE RISK ASSESSMENT SITE A12/P36/P37

Receptor	Age Group	Exposure Case	Exposure Route	Exposure Area	Exposure and Risk Estimates Table
Site Trespasser	Adolescent	RME	1A Soil ingestion 1B Dermal contact	Site A12/P36/P37	O.2-2
		Average	1A Soil ingestion 1B Dermal contact	Site A12/P36/P37	O.2-3
		RME	1C Sediment ingestion 1D Dermal contact	Marlboro Brook	O.2-4
		Average	1C Sediment ingestion 1D Dermal contact	Marlboro Brook	O.2-5
Future Site Resident	Adult	RME	2A Soil ingestion 2B Dermal contact	Site A12/P36/P37	O.2-6
		Average	2A Soil ingestion 2B Dermal contact	Site A12/P36/P37	O.2-7
	Child	RME	2A Soil ingestion 2B Dermal contact	Site A12/P36/P37	O.2-8
		Average	2A Soil ingestion 2B Dermal contact	Site A12/P36/P37	O.2-9
	Adolescent	RME	2C Sediment ingestion 2D Dermal contact	Marlboro Brook	O.2-10
		Average	2C Sediment ingestion 2D Dermal contact	Marlboro Brook	O.2-11
	Adult	RME	2E Groundwater ingestion	Site A12/P36/P37 (unfiltered)	O.2-12
		Average	2E Groundwater ingestion	Site A12/P36/P37 (unfiltered)	O.2-13
	Child	RME	2E Groundwater ingestion	Site A12/P36/P37 (unfiltered)	O.2-14
		Average	2E Groundwater ingestion	Site A12/P36/P37 (unfiltered)	O.2-15
	Adult	RME	2E Groundwater ingestion	Site A12/P36/P37 (filtered)	O.2-16
		Average	2E Groundwater ingestion	Site A12/P36/P37 (filtered)	O.2-17
	Child	RME	2E Groundwater ingestion	Site A12/P36/P37 (filtered)	O.2-18
		Average	2E Groundwater ingestion	Site A12/P36/P37 (filtered)	O.2-19

Key:

RME = Reasonable Maximum Exposure.

Table 0.2-2

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
SITE TRESPASSER EXPOSURE TO SOIL
Location: Site A12/P36/P37
Receptor: Adolescent
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Chemicals in Soil					
Antimony	5.74E-00	--	--	1.75E-06	4.38E-03
PCB 1254	2.00E-00	3.13E-08	2.41E-07	1.83E-07	9.15E-03
PCB 1260	6.30E-00	9.86E-08	7.59E-07	--	--
Arsenic	1.40E+01	7.31E-07	1.32E-06	4.26E-06	1.42E-02
Barium	2.00E+02	--	--	6.09E-05	8.70E-04
Benzo(b)fluoranthene	8.20E-02	4.28E-09	3.12E-09	2.50E-08	6.25E-07
Beryllium	5.81E-01	3.03E-08	1.30E-07	1.77E-07	3.54E-05
Bis(2-ethylhexyl)phthalate	1.30E-00	6.78E-08	9.49E-10	3.96E-07	1.98E-05
Butyl Benzyl Phthalate	6.00E-01	--	--	1.83E-07	9.15E-07
Cadmium (soil)	1.53E+01	--	--	4.66E-06	4.66E-03
Chlordane	7.25E-02	1.14E-09	1.48E-09	6.62E-09	1.10E-04
Chromium(III)	6.60E+01	--	--	2.01E-05	2.01E-05
Chromium(VI)	7.30E-00	--	--	2.22E-06	4.44E-04
Copper	9.14E+01	--	--	2.78E-05	7.51E-04
P,P'-DDT	9.40E-01	1.47E-08	5.00E-09	8.58E-08	1.72E-04
Endosulfan II(beta)	1.11E-01	--	--	3.38E-08	5.63E-06
Fluoranthene	8.10E-02	--	--	2.47E-08	6.18E-07
Lead	2.60E+02	--	--	--	--
Manganese (soil)	3.46E+02	--	--	1.05E-04	7.50E-04
Nickel (Soluble Salts)	4.36E+01	--	--	1.33E-05	6.65E-04
Pyrene	9.00E-02	--	--	2.74E-08	9.13E-07
Vanadium	3.63E+01	--	--	1.11E-05	1.59E-03
Zinc	2.30E+03	--	--	7.00E-04	2.33E-03
Ingestion Route Subtotal:			2.46E-06		4.02E-02

Table O.2-2 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Dermal Contact with Contaminated Soil					
PCB 1254	2.00E-00	2.57E-07	1.98E-06	1.50E-06	7.50E-02
PCB 1260	6.30E-00	8.09E-07	6.23E-06	--	--
Cadmium (soil)	1.53E+01	--	--	1.91E-07	1.91E-03
Dermal Route Subtotal:			8.21E-06		7.69E-02
Receptor Total:			1.07E-05		1.17E-01

Table 0.2-3

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
SITE TRESPASSER EXPOSURE TO SOIL
Location: Site A12/P36/P37
Receptor: Adolescent
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects		Non-Carcinogenic Effects	
		Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index
Exposure Route: Ingestion of Chemicals in Soil					
Antimony	8.22E-01	--	--	2.50E-07	6.25E-04
PCB 1254	1.10E-01	1.72E-09	1.32E-08	1.00E-08	5.00E-04
PCB 1260	8.33E-01	1.30E-08	1.00E-07	--	--
Arsenic	7.57E-00	3.95E-07	7.11E-07	2.30E-06	7.67E-03
Barium	3.76E+01	--	--	1.14E-05	1.63E-04
Benzo(b)fluoranthene	8.20E-02	4.28E-09	3.12E-09	2.50E-08	6.25E-07
Beryllium	3.74E-01	1.95E-08	8.39E-08	1.14E-07	2.28E-05
Bis(2-ethylhexyl)phthalate	3.10E-01	1.62E-08	2.27E-10	9.44E-08	4.72E-06
Butyl Benzyl Phthalate	1.92E-01	--	--	5.84E-08	2.92E-07
Cadmium (soil)	2.50E-00	--	--	7.61E-07	7.61E-04
Chlordane	6.00E-03	9.39E-11	1.22E-10	5.48E-10	9.13E-06
Chromium(III)	1.80E+01	--	--	5.48E-06	5.48E-06
Chromium(VI)	2.00E-00	--	--	6.09E-07	1.22E-04
Copper	2.38E+01	--	--	7.25E-06	1.96E-04
P,P'-DDT	1.26E-01	1.97E-09	6.70E-10	1.15E-08	2.30E-05
Endosulfan II(beta)	1.40E-02	--	--	4.26E-09	7.10E-07
Fluoranthene	8.10E-02	--	--	2.47E-08	6.18E-07
Lead	4.29E+01	--	--	--	--
Manganese (soil)	1.58E+02	--	--	4.81E-05	3.44E-04
Nickel (Soluble Salts)	1.53E+01	--	--	4.66E-06	2.33E-04
Pyrene	9.00E-02	--	--	2.74E-08	9.13E-07
Vanadium	2.30E+01	--	--	7.00E-06	1.00E-03
Zinc	5.27E+02	--	--	1.60E-04	5.33E-04
Ingestion Route Subtotal:			9.12E-07		1.21E-02

Table 0.2-3 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Dermal Contact with Contaminated Soil					
PCB 1254	1.10E-01	1.41E-08	1.09E-07	8.24E-08	4.12E-03
PCB 1260	8.33E-01	1.07E-07	8.24E-07	--	--
Cadmium (soil)	2.50E-00	--	--	3.12E-07	3.12E-04
Dermal Route Subtotal:			9.33E-07		4.43E-03
Receptor Total:			1.85E-06		1.65E-02

Table 0.2-4

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
SITE TRESPASSER EXPOSURE TO SEDIMENT
Location: Site A12/P36/P37, Marlboro Brook
Receptor: Adolescent
Case: Reasonable Maximim Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Chemicals in Sediment					
Antimony	1.72E-00	--	--	1.57E-07	3.93E-04
Arsenic	3.74E+01	5.86E-07	1.05E-06	3.42E-06	1.14E-02
Barium	7.29E+01	--	--	6.66E-06	9.51E-05
Beryllium	1.09E-00	1.71E-08	7.35E-08	9.95E-08	1.99E-05
Cadmium (soil)	2.50E-00	--	--	2.28E-07	2.28E-04
Chlordane	1.90E-01	8.92E-10	1.16E-09	5.21E-09	8.68E-05
Chromium(III)	9.10E-00	--	--	8.31E-07	8.31E-07
Chromium(VI)	1.00E-00	--	--	9.13E-08	1.83E-05
Copper	1.54E+01	--	--	1.41E-06	3.81E-05
P,P'-DDE	3.45E-01	1.62E-09	5.51E-10	--	--
Endosulfan II(beta)	1.00E-03	--	--	9.13E-11	1.52E-08
Endrin	2.40E-02	--	--	6.58E-10	2.19E-06
Fluoranthene	2.90E-01	--	--	2.65E-08	6.63E-07
Heptachlor Epoxide	1.14E-01	5.35E-10	4.87E-09	3.12E-09	2.40E-04
Alpha-Hexachlorocyclohexane	2.70E-02	4.23E-10	2.66E-09	--	--
Lead	3.92E+01	--	--	--	--
Manganese (soil)	1.68E+03	--	--	1.53E-04	1.09E-03
Nickel (Soluble Salts)	2.07E+01	--	--	1.89E-06	9.45E-05
Pyrene	3.10E-01	--	--	2.83E-08	9.43E-07
Selenium	8.52E-01	--	--	7.78E-08	1.56E-05
Toluene	3.00E-02	--	--	2.74E-09	1.37E-08
Vanadium	2.18E+01	--	--	1.99E-06	2.84E-04
Zinc	7.29E+01	--	--	6.66E-06	2.22E-05
Ingestion Route Subtotal:			1.12E-06		1.39E-02

Table 0.2-4 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects		Non-Carcinogenic Effects	
		Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index
Exposure Route: Dermal Contact with Contaminated Sediment					
Cadmium (soil)	2.50E-00	--	--	9.36E-08	9.36E-05
Dermal Route Subtotal:			0.00E+00		9.36E-05
Receptor Total:			1.12E-06		1.40E-02

Table 0.2-5

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
SITE TRESPASSER EXPOSURE TO SEDIMENT
Location: Site A12/P36/P37, Marlboro Brook
Receptor: Adolescent
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects Intake (mg/kg/day)	Carcinogenic Effects Cancer Risk	Non-Carcinogenic Effects Intake (mg/kg/day)	Non-Carcinogenic Effects Hazard Index
Exposure Route: Ingestion of Chemicals in Sediment					
Antimony	7.40E-01	--	--	6.76E-08	1.69E-04
Arsenic	1.64E+01	2.57E-07	4.63E-07	1.50E-06	5.00E-03
Barium	3.77E+01	--	--	3.44E-06	4.91E-05
Beryllium	6.80E-01	1.06E-08	4.56E-08	6.21E-08	1.24E-05
Cadmium (soil)	2.50E-00	--	--	2.28E-07	2.28E-04
Chlordane	1.90E-01	8.92E-10	1.16E-09	5.21E-09	8.68E-05
Chromium(III)	7.15E+01	--	--	6.53E-06	6.53E-06
Chromium(VI)	7.90E-00	--	--	7.21E-07	1.44E-04
Copper	9.01E-00	--	--	8.23E-07	2.22E-05
P,P'-DDE	2.21E-01	1.04E-09	3.54E-10	--	--
Endosulfan II(beta)	1.00E-03	--	--	9.13E-11	1.52E-08
Endrin	2.40E-02	--	--	6.58E-10	2.19E-06
Fluoranthene	2.07E-01	--	--	1.89E-08	4.73E-07
Heptachlor Epoxide	5.80E-02	2.72E-10	2.48E-09	1.59E-09	1.22E-04
Alpha-Hexachlorocyclohexane	9.70E-03	1.52E-10	9.58E-10	--	--
Lead	2.09E+01	--	--	--	--
Manganese (soil)	6.66E+02	--	--	6.08E-05	4.34E-04
Nickel (Soluble Salts)	1.21E+01	--	--	1.11E-06	5.55E-05
Pyrene	2.13E-01	--	--	1.95E-08	6.50E-07
Selenium	3.51E-01	--	--	3.21E-08	6.42E-06
Toluene	1.20E-02	--	--	1.10E-09	5.50E-09
Vanadium	1.32E+01	--	--	1.21E-06	1.73E-04
Zinc	4.92E+01	--	--	4.49E-06	1.50E-05
Ingestion Route Subtotal:			5.13E-07		6.52E-03

Table 0.2-5 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects Intake (mg/kg/day)	Carcinogenic Effects Cancer Risk	Non-Carcinogenic Effects Intake (mg/kg/day)	Non-Carcinogenic Effects Hazard Index
Exposure Route: Dermal Contact with Contaminated Sediment					
Cadmium (soil)	2.50E-00	--	--	9.36E-08	9.36E-05
Dermal Route Subtotal:			0.00E+00		9.36E-05
Receptor Total:			5.13E-07		6.61E-03

Table O.2-6

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE TO SOIL
Location: Site A12/P36/P37
Receptor: Adult
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects		Non-Carcinogenic Effects	
		Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index
Exposure Route: Ingestion of Chemicals in Soil					
Antimony	5.74E-00	--	--	7.86E-06	1.97E-02
PCB 1254	2.00E-00	3.52E-07	2.71E-06	8.22E-07	4.11E-02
PCB 1260	6.30E-00	1.11E-06	8.55E-06	--	--
Arsenic	1.40E+01	8.22E-06	1.48E-05	1.92E-05	6.40E-02
Barium	2.00E+02	--	--	2.74E-04	3.91E-03
Benzo(b)fluoranthene	8.20E-02	4.81E-08	3.51E-08	1.12E-07	2.80E-06
Beryllium	5.81E-01	3.41E-07	1.47E-06	7.96E-07	1.59E-04
Bis(2-ethylhexyl)phthalate	1.30E-00	7.63E-07	1.07E-08	1.78E-06	8.90E-05
Butyl Benzyl Phthalate	1.05E-00	--	--	1.44E-06	7.20E-06
Cadmium (soil)	6.43E+01	--	--	8.81E-05	8.81E-02
Chlordane	7.25E-02	1.28E-08	1.66E-08	2.98E-08	4.97E-04
Chromium(III)	6.60E+01	--	--	9.04E-05	9.04E-05
Chromium(VI)	7.30E-00	--	--	1.00E-05	2.00E-03
Copper	9.14E+01	--	--	1.25E-04	3.38E-03
P,P'-DDT	9.40E-01	1.66E-07	5.64E-08	3.86E-07	7.72E-04
Di-n-octyl Phthalate	1.20E-01	--	--	1.64E-07	8.20E-06
Endosulfan II(beta)	1.11E-01	--	--	1.52E-07	2.53E-05
Fluoranthene	8.10E-02	--	--	1.11E-07	2.78E-06
Lead	2.60E+02	--	--	--	--
Manganese (soil)	3.46E+02	--	--	4.74E-04	3.39E-03
Nickel (Soluble Salts)	4.36E+01	--	--	5.97E-05	2.99E-03
Pyrene	9.00E-02	--	--	1.23E-07	4.10E-06
Vanadium	3.63E+01	--	--	4.97E-05	7.10E-03
Zinc	2.30E+03	--	--	3.15E-03	1.05E-02
Ingestion Route Subtotal:			2.77E-05		2.47E-01

Table O.2-6 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects Intake (mg/kg/day)	Carcinogenic Effects Cancer Risk	Non-Carcinogenic Effects Intake (mg/kg/day)	Non-Carcinogenic Effects Hazard Index
Exposure Route: Dermal Contact with Contaminated Soil					
PCB 1254	2.00E-00	4.02E-06	3.10E-05	9.37E-06	4.69E-01
PCB 1260	6.30E-00	1.26E-05	9.70E-05	--	--
Cadmium (soil)	6.43E+01	--	--	5.02E-05	5.02E-02
Dermal Route Subtotal:			1.28E-04		5.19E-01
Receptor Total:			1.56E-04		7.66E-01

Table O.2-7

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE TO SOIL
Location: Site A12/P36/P37
Receptor: Adult
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects		Non-Carcinogenic Effects	
		Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index
Exposure Route: Ingestion of Chemicals in Soil					
Antimony	6.17E-01	--	--	8.45E-07	2.11E-03
PCB 1254	7.00E-02	1.23E-08	9.47E-08	2.88E-08	1.44E-03
PCB 1260	5.29E-01	9.32E-08	7.18E-07	--	--
Arsenic	6.37E-00	3.74E-06	6.73E-06	8.73E-06	2.91E-02
Barium	3.32E+01	--	--	4.55E-05	6.50E-04
Benzo(b)fluoranthene	8.20E-02	4.81E-08	3.51E-08	1.12E-07	2.80E-06
Beryllium	3.44E-01	2.02E-07	8.69E-07	4.71E-07	9.42E-05
Bis(2-ethylhexyl)phthalate	2.44E-01	1.43E-07	2.00E-09	3.34E-07	1.67E-05
Butyl Benzyl Phthalate	1.78E-01	--	--	2.44E-07	1.22E-06
Cadmium (soil)	3.99E-00	--	--	5.47E-06	5.47E-03
Chlordane	6.00E-03	1.06E-09	1.38E-09	2.47E-09	4.12E-05
Chromium(III)	1.49E+01	--	--	2.04E-05	2.04E-05
Chromium(VI)	1.70E-00	--	--	2.33E-06	4.66E-04
Copper	1.79E+01	--	--	2.45E-05	6.62E-04
P,P'-DDT	8.10E-02	1.43E-08	4.86E-09	3.33E-08	6.66E-05
Di-n-octyl Phthalate	7.40E-02	--	--	1.01E-07	5.05E-06
Endosulfan II(beta)	1.10E-02	--	--	1.51E-08	2.52E-06
Fluoranthene	8.10E-02	--	--	1.11E-07	2.78E-06
Lead	3.75E+01	--	--	--	--
Manganese (soil)	1.35E+02	--	--	1.85E-04	1.32E-03
Nickel (Soluble Salts)	1.30E+01	--	--	1.78E-05	8.90E-04
Pyrene	9.00E-02	--	--	1.23E-07	4.10E-06
Vanadium	1.95E+01	--	--	2.67E-05	3.81E-03
Zinc	3.07E+02	--	--	4.21E-04	1.40E-03
Ingestion Route Subtotal:			8.45E-06		4.77E-02

Table 0.2-7 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Dermal Contact with Contaminated Soil					
PCB 1254	7.00E-02	1.41E-07	1.09E-06	3.28E-07	1.64E-02
PCB 1260	5.29E-01	1.06E-06	8.16E-06	--	--
Cadmium (soil)	3.99E-00	--	--	3.12E-06	3.12E-03
Dermal Route Subtotal:			9.25E-06		1.95E-02
Receptor Total:			1.77E-05		6.72E-02

Table 0.2-8

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE TO SOIL
Location: Site A12/P36/P37
Receptor: Child
Case: Reasonable Maximum Exposure

		Carcinogenic Effects		Non-Carcinogenic Effects	
Chemical	Exposure Point Concentration (mg/kg)	Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index[a]
Exposure Route: Ingestion of Chemicals in Soil					
Antimony	5.74E-00	--	--	7.34E-05	1.84E-01
PCB 1254	2.00E-00	6.58E-07	5.07E-06	7.67E-06	3.84E-01
PCB 1260	6.30E-00	2.07E-06	1.59E-05	--	--
Arsenic	1.40E+01	1.53E-05	2.75E-05	1.79E-04	5.97E-01
Barium	2.00E+02	--	--	2.56E-03	3.66E-02
Benzo(b)fluoranthene	8.20E-02	8.99E-08	6.56E-08	1.05E-06	2.63E-05
Beryllium	5.81E-01	6.37E-07	2.74E-06	7.43E-06	1.49E-03
Bis(2-ethylhexyl)phthalate	1.30E-00	1.42E-06	1.99E-08	1.66E-05	8.30E-04
Butyl Benzyl Phthalate	1.05E-00	--	--	1.34E-05	6.70E-06
Cadmium (soil)	6.43E+01	--	--	8.22E-04	8.22E-01
Chlordane	7.25E-02	2.38E-08	3.09E-08	2.78E-07	4.63E-03
Chromium(III)	6.60E+01	--	--	8.44E-04	8.44E-04
Chromium(VI)	7.30E-00	--	--	9.33E-05	4.67E-03
Copper	9.14E+01	--	--	1.17E-03	3.16E-02
P,P'-DDT	9.40E-01	3.09E-07	1.05E-07	3.61E-06	7.22E-03
Di-n-octyl Phthalate	1.20E-01	--	--	1.53E-06	7.65E-05
Endosulfan II(beta)	1.11E-01	--	--	1.42E-06	2.37E-04
Fluoranthene	8.10E-02	--	--	1.04E-06	2.60E-06
Lead	2.60E+02	--	--	--	--
Manganese (soil)	3.46E+02	--	--	4.42E-03	3.16E-02
Nickel (Soluble Salts)	4.36E+01	--	--	5.57E-04	2.79E-02
Pyrene	9.00E-02	--	--	1.15E-06	3.83E-06
Vanadium	3.63E+01	--	--	4.64E-04	6.63E-02
Zinc	2.30E+03	--	--	2.94E-02	9.80E-02
Ingestion Route Subtotal:			5.14E-05		2.30E+00

Table O.2-8 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index[a]
Exposure Route: Dermal Contact with Contaminated Soil					
PCB 1254	2.00E-00	2.10E-06	1.62E-05	2.45E-05	1.23E+00
PCB 1260	6.30E-00	6.63E-06	5.11E-05	--	--
Cadmium (soil)	6.43E+01	--	--	1.32E-04	1.32E-01
Dermal Route Subtotal:			6.73E-05		1.36E+00
Receptor Total:			1.19E-04		3.66E+00

[a]Calculated using subchronic RfD.

Table 0.2-9

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE TO SOIL
Location: Site A12/P36/P37
Receptor: Child
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index[a]
Exposure Route: Ingestion of Chemicals in Soil					
Antimony	6.17E-01	--	--	7.89E-06	1.97E-02
PCB 1254	7.00E-02	2.30E-08	1.77E-07	2.68E-07	1.34E-02
PCB 1260	5.29E-01	1.74E-07	1.34E-06	--	--
Arsenic	6.37E-00	6.98E-06	1.26E-05	8.14E-05	2.71E-01
Barium	3.32E+01	--	--	4.24E-04	6.06E-03
Benzo(b)fluoranthene	8.20E-02	8.99E-08	6.56E-08	1.05E-06	2.63E-05
Beryllium	3.44E-01	3.77E-07	1.62E-06	4.40E-06	8.80E-04
Bis(2-ethylhexyl)phthalate	2.44E-01	2.67E-07	3.74E-09	3.12E-06	1.56E-04
Butyl Benzyl Phthalate	1.78E-01	--	--	2.28E-06	1.14E-06
Cadmium (soil)	3.99E-00	--	--	5.10E-05	5.10E-02
Chlordane	6.00E-03	1.97E-09	2.56E-09	2.30E-08	3.83E-04
Chromium(III)	1.49E+01	--	--	1.91E-04	1.91E-04
Chromium(VI)	1.70E-00	--	--	2.17E-05	1.09E-03
Copper	1.79E+01	--	--	2.29E-04	6.19E-03
P,P'-DDT	8.10E-02	2.66E-08	9.04E-09	3.11E-07	6.22E-04
Di-n-octyl Phthalate	7.40E-02	--	--	9.46E-07	4.73E-05
Endosulfan II(beta)	1.10E-02	--	--	1.41E-07	2.35E-05
Fluoranthene	8.10E-02	--	--	1.04E-06	2.60E-06
Lead	3.75E+01	--	--	--	--
Manganese (soil)	1.35E+02	--	--	1.73E-03	1.24E-02
Nickel (Soluble Salts)	1.30E+01	--	--	1.66E-04	8.30E-03
Pyrene	9.00E-02	--	--	1.15E-06	3.83E-06
Vanadium	1.95E+01	--	--	2.49E-04	3.56E-02
Zinc	3.07E+02	--	--	3.93E-03	1.31E-02
Ingestion Route Subtotal:			1.58E-05		4.39E-01

Table 0.2-9 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index[a]
Exposure Route: Dermal Contact with Contaminated Soil					
PCB 1254	7.00E-02	7.36E-08	5.67E-07	8.59E-07	4.30E-02
PCB 1260	5.29E-01	5.57E-07	4.29E-06	--	--
Cadmium (soil)	3.99E-00	--	--	8.16E-06	8.16E-03
Dermal Route Subtotal:			4.86E-06		5.12E-02
Receptor Total:			2.07E-05		4.90E-01

[a]Calculated using subchronic RfD.

Table O.2-10

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE TO SEDIMENT
Location: Site A12/P36/P37, Marlboro Brook
Receptor: Adolescent
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Chemicals in Sediment					
Antimony	1.72E-00	--	--	5.24E-07	1.31E-03
Arsenic	3.74E+01	1.95E-06	3.51E-06	1.14E-05	3.80E-02
Barium	7.29E+01	--	--	2.22E-05	3.17E-04
Beryllium	1.09E-00	5.69E-08	2.45E-07	3.32E-07	6.64E-05
Cadmium (soil)	2.50E-00	--	--	7.61E-07	7.61E-04
Chlordane	1.90E-01	2.97E-09	3.86E-09	1.74E-08	2.90E-04
Chromium(III)	9.10E-00	--	--	2.77E-06	2.77E-06
Chromium(VI)	1.00E-00	--	--	3.04E-07	6.08E-05
Copper	1.54E+01	--	--	4.69E-06	1.27E-04
P,P'-DDE	3.45E-01	5.40E-09	1.84E-09	--	--
Endosulfan II(beta)	1.00E-03	--	--	3.04E-10	5.07E-08
Endrin	2.40E-02	--	--	2.19E-09	7.30E-06
Fluoranthene	2.90E-01	--	--	8.83E-08	2.21E-06
Heptachlor Epoxide	1.14E-01	1.78E-09	1.62E-08	1.04E-08	8.00E-04
Alpha-Hexachlorocyclohexane	2.70E-02	1.41E-09	8.88E-09	--	--
Lead	3.92E+01	--	--	--	--
Manganese (soil)	1.68E+03	--	--	5.11E-04	3.65E-03
Nickel (Soluble Salts)	2.07E+01	--	--	6.30E-06	3.15E-04
Pyrene	3.10E-01	--	--	9.44E-08	3.15E-06
Selenium	8.52E-01	--	--	2.59E-07	5.18E-05
Toluene	3.00E-02	--	--	9.13E-09	4.57E-08
Vanadium	2.18E+01	--	--	6.64E-06	9.49E-04
Zinc	7.29E+01	--	--	2.22E-05	7.40E-05
Ingestion Route Subtotal:			3.79E-06		4.69E-02

Table O.2-10 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Dermal Contact with Contaminated Sediment					
Cadmium (soil)	2.50E-00	--	--	3.12E-07	3.12E-04
Dermal Route Subtotal:			0.00E+00		3.12E-04
Receptor Total:			3.79E-06		4.72E-02

Table 0.2-11

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE TO SEDIMENT
Location: Site A12/P36/P37, Marlboro Brook
Receptor: Adolescent
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Chemicals in Sediment					
Antimony	7.40E-01	--	--	2.25E-07	5.63E-04
Arsenic	1.64E+01	8.56E-07	1.54E-06	4.99E-06	1.66E-02
Barium	3.77E+01	--	--	1.15E-05	1.64E-04
Beryllium	6.80E-01	3.55E-08	1.53E-07	2.07E-07	4.14E-05
Cadmium (soil)	2.50E-00	--	--	7.61E-07	7.61E-04
Chlordane	1.90E-01	2.97E-09	3.86E-09	1.74E-08	2.90E-04
Chromium(III)	7.15E+01	--	--	2.18E-05	2.18E-05
Chromium(VI)	7.90E-00	--	--	2.40E-06	4.80E-04
Copper	9.01E-00	--	--	2.74E-06	7.41E-05
P,P'-DDE	2.21E-01	3.46E-09	1.18E-09	--	--
Endosulfan II(beta)	1.00E-03	--	--	3.04E-10	5.07E-08
Endrin	2.40E-02	--	--	2.19E-09	7.30E-06
Fluoranthene	2.07E-01	--	--	6.30E-08	1.58E-06
Heptachlor Epoxide	5.80E-02	9.08E-10	8.26E-09	5.30E-09	4.08E-04
Alpha-Hexachlorocyclohexane	9.70E-03	5.06E-10	3.19E-09	--	--
Lead	2.09E+01	--	--	--	--
Manganese (soil)	6.66E+02	--	--	2.03E-04	1.45E-03
Nickel (Soluble Salts)	1.21E+01	--	--	3.68E-06	1.84E-04
Pyrene	2.13E-01	--	--	6.48E-08	2.16E-06
Selenium	3.51E-01	--	--	1.07E-07	2.14E-05
Toluene	1.20E-02	--	--	3.65E-09	1.83E-08
Vanadium	1.32E+01	--	--	4.02E-06	5.74E-04
Zinc	4.92E+01	--	--	1.50E-05	5.00E-05
Ingestion Route Subtotal:			1.70E-06		2.19E-02

Table O.2-11 (Cont.)

Chemical	Exposure Point Concentration (mg/kg)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Dermal Contact with Contaminated Sediment					
Cadmium (soil)	2.50E-00	--	--	3.12E-07	3.12E-04
Dermal Route Subtotal:			0.00E+00		3.12E-04
Receptor Total:			1.70E-06		2.22E-02

Table 0.2-12

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Unfiltered
Location: Site A12/P36/P37
Receptor: Adult
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/L)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Drinking Water					
Arsenic	1.00E-01	1.17E-03	2.11E-03	2.74E-03	9.13E+00
Lead	2.98E-02	--	--	--	--
Zinc	2.82E-01	--	--	7.73E-03	2.58E-02
Ingestion Route Subtotal:			2.11E-03		1.02E+01
Receptor Total:			2.11E-03		9.16E+00

11:UC6101-RC1287_V4-03/15/95-D2

Table O.2-13

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Unfiltered
Location: Site A12/P36/P37
Receptor: Adult
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/L)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Drinking Water					
Arsenic	2.36E-02	2.77E-04	4.99E-04	6.47E-04	2.16E+00
Lead	8.80E-03	--	--	--	--
Zinc	9.54E-02	--	--	2.61E-03	8.70E-03
Ingestion Route Subtotal:			4.99E-04		2.17E+00
Receptor Total:			4.99E-04		2.17E+00

11:UC6101_RC1287_V4-03/15/95-D2

Table O.2-14

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Unfiltered
Location: Site A12/P36/P37
Receptor: Child
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/L)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index[a]
Exposure Route: Ingestion of Drinking Water					
Arsenic	1.00E-01	5.48E-04	9.86E-04	6.39E-03	2.13E+01
Lead	2.98E-02	--	--	--	--
Zinc	2.82E-01	--	--	1.80E-02	6.00E-02
Ingestion Route Subtotal:			9.86E-04		2.13E+01
Receptor Total:			9.86E-04		2.13E+01

[a]Calculated using subchronic RfD.

11:UC6101_RC1287_V4-03/15/95-D2

Table 0.2-15

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Unfiltered
Location: Site A12/P36/P37
Receptor: Child
Case: Average Exposure

		Carcinogenic Effects		Non-Carcinogenic Effects	
Chemical	Exposure Point Concentration (mg/L)	Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index[a]
Exposure Route: Ingestion of Drinking Water					
Arsenic	2.36E-02	1.29E-04	2.32E-04	1.51E-03	5.03E+00
Lead	8.80E-03	--	--	--	--
Zinc	9.54E-02	--	--	6.10E-03	2.03E-02
Ingestion Route Subtotal:			2.32E-04		5.05E+00
Receptor Total:			2.32E-04		5.05E+00

[a]Calculated using subchronic RfD.

Table 0.2-16

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Filtered[a]
Location: Site A12/P36/P37
Receptor: Adult
Case: Reasonable Maximum Exposure

Chemical	Exposure Point Concentration (mg/L)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Drinking Water					
Arsenic	2.14E-03	2.51E-05	4.52E-05	5.86E-05	1.95E-01
Lead	2.50E-03	--	--	--	--
Zinc	7.19E-03	--	--	1.97E-04	6.57E-04
Ingestion Route Subtotal:			4.52E-05		1.96E-01
Receptor Total:			4.52E-05		1.96E-01

[a]All groundwater COPCs included. Inorganic COPCs not detected in filtered groundwater were assumed to be present at 1/2 their respective quantitation limits.

Table 0.2-17

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Filtered[a]
Location: Site A12/P36/P37
Receptor: Adult
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/L)	Carcinogenic Effects: Intake (mg/kg/day)	Carcinogenic Effects: Cancer Risk	Non-Carcinogenic Effects: Intake (mg/kg/day)	Non-Carcinogenic Effects: Hazard Index
Exposure Route: Ingestion of Drinking Water					
Arsenic	1.13E-03	1.33E-05	2.39E-05	3.10E-05	1.03E-01
Lead	2.50E-03	--	--	--	--
Zinc	7.19E-02	--	--	1.97E-03	6.57E-03
Ingestion Route Subtotal:			2.39E-05		1.10E-01
Receptor Total:			2.39E-05		1.10E-01

[a]All groundwater COPCs included. Inorganic COPCs not detected in filtered groundwater were assumed to be present at 1/2 their respective quantitation limits.

Table O.2-18

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Filtered[a]
Location: Site A12/P36/P37
Receptor: Child
Case: Reasonable Maximum Exposure

		Carcinogenic Effects		Non-Carcinogenic Effects	
Chemical	Exposure Point Concentration (mg/L)	Intake (mg/kg/day)	Cancer Risk	Intake (mg/kg/day)	Hazard Index[b]
Exposure Route: Ingestion of Drinking Water					
Arsenic	2.14E-03	1.17E-05	2.11E-05	1.37E-04	4.57E-01
Lead	2.50E-03	--	--	--	--
Zinc	7.19E-03	--	--	4.60E-04	1.53E-03
Ingestion Route Subtotal:			2.11E-05		4.59E-01
Receptor Total:			2.11E-05		4.59E-01

[a]All groundwater COPCs included. Inorganic COPCs not detected in filtered groundwater were assumed to be present at 1/2 their respective quantitation limits.

[b]Calculated using subchronic RfD.

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Table 0.2-19

CANCER RISK AND NONCANCER HAZARD INDEX ESTIMATES
FUTURE SITE RESIDENT EXPOSURE - GROUNDWATER USAGE
Filtered[a]
Location: Site A12/P36/P37
Receptor: Child
Case: Average Exposure

Chemical	Exposure Point Concentration (mg/L)	Carcinogenic Effects Intake (mg/kg/day)	Carcinogenic Effects Cancer Risk	Non-Carcinogenic Effects Intake (mg/kg/day)	Non-Carcinogenic Effects Hazard Index[b]
Exposure Route: Ingestion of Drinking Water					
Arsenic	1.13E-03	6.19E-06	1.11E-05	7.22E-05	2.41E-01
Lead	2.50E-03	--	--	--	--
Zinc	7.19E-02	--	--	4.60E-03	1.53E-02
Ingestion Route Subtotal:			1.11E-05		2.56E-01
Receptor Total:			1.11E-05		2.56E-01

[a]All groundwater COPCs included. Inorganic COPCs not detected in filtered groundwater were assumed to be present at 1/2 their respective quantitation limits.

[b]Calculated using subchronic RfD.